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ACROSS THE GREEN MOUNTAINS OF OMAN.

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Jebel Akhdar, or the Green Mountain, as the Arabs call it, lies about 60 miles south-west of Muskat, and is the central and culminating point of the great chain forming the backbone of Oman. Viewed from the nearest part of the coast, some 40 miles away, this gigantic mass looms, a most conspicuous and majestic feature, in the distance, its dark precipitous front rising abruptly, cliff above cliff, in wild and desolate nakedness to a height of nearly 10,000 feet. The sight of the mountain is so impressive that from the moment I first saw it I made the determination to visit it, and the accounts I subsequently heard of its inhabitants and pensile gardens increased my desire to make its acquaintance. But the country at that period was very unsettled, tribal and dynastic wars being of perpetual occurrence, and it was not for several years that a fitting opportunity for carrying out my design presented itself.

In the middle of the year 1876 I found myself able to undertake the trip, and the Sultan having caused instructions to be despatched to the Governor of Nakhl to make arrangements with the Beni Riyam who possess Jebel Akhdar, and other tribes on the way, to provide an escort, I sailed from Muskat on June 27 in a native boat for Sib, where I landed and camped for the night in a garden near the shore. The next morning, having procured camels, I started in company with two sheikhs, who had come from Nakhl to meet me, for Burka, where I arrived about mid-day. After an interview with the governor and a short rest, we resumed our journey and struck inland in a direction almost due south, the path leading along the Wady Hammam.

We were now traversing the eastern part of the maritime plain

known as the Batina, which, except in the oases, is an uncultivated desert, the surface being in some parts sandy, in others stony. At 10 miles we came suddenly upon a small but rich oasis named El Wasit, near the junction of the Wadis Hammam and Maawal, where we experienced, in the cool and humid atmosphere of the date groves, a most refreshing change from the heat and glare. We now ascended the Wady Maawal, and, skirting the base of the Nakhl range, arrived, after another hour or so, at the village of Hibra, where we stopped for the night at the house of Sezzid Ali, a grand-nephew of the Sultan. The Wady Maawal is known in the upper part as Wady Mayin, and has several villages, viz. Jenab, Hibra, Afy, Musalmat, Wasit, etc. The Maawal tribe to which it belongs is Kahtanite, and numbers about twelve thousand souls. In the fifth or sixth century of our era this tribe began to assume a predominant position in the country, as the Julanda princes who then ruled over Oman belonged to a Maawal family, a circumstance which gave the tribe a status analogous to that held by the Âl Bu Saidis at the present day. The Julanda dynasty is supposed to be referred to in the Koran (Sura 18). It acquired great reputation in the Moslem world from the action of the brothers Abd and Jaifar, who reigned at Nezwa in the Time of Ignorance, and who accepted the new faith immediately on receipt of the prophet's letter of invitation, and championed it against the idolaters in Oman. The persecutions of Mowiya and Hejaj brought the dynasty to an end, and compelled the last of the line to seek safety in exile. The Maawal tribe was ever unfriendly towards H.H. Sezzid Turky, and was severely chastised in 1883 for their share in the attack on Muskat.

The following day we entered the ravine leading to the secluded glen where lay embosomed the town of Nakhl, or, as one may call it, for the three words have the same signification, Palmyra or Tadmor. The approach was one of striking and impressive singularity. We were now close under the lofty mass of Jebel Nakhl, which, rising abruptly, towered over us to a height of 5240 feet, and as we rode up the winding torrent bed, it seemed as if we were about to penetrate the very bowels of the mountain. No sign of human habitation, no cultivation, no gardens were visible, nothing but dark and desolate rocks met the eye; the silence was profound, and I was wondering where the town could possibly be, when from above, in front of us, several matchlocks were suddenly discharged in our direction, and I perceived a watch tower perched on a steep pinnacle 200 feet high, standing guard, as it were, over the entrance, and from which the sentries had fired to give notice of our approach. Rounding an angle, we were now confronted with the massive ramparts of the fortress, which, warned by the watch tower, immediately began to fire a salute from a battery of twelve-pounder iron guns, the sound of which reverberated sharply from the rocky walls of the glen. The town itself,

however, still remained invisible until, skirting the pinnacle, we passed under a two-arched viaduct, when the whole settlement, houses, palms, gardens, orchards, and cultivation, burst upon the view, presenting a scene of a very picturesque character. It was getting hot when we arrived, and though the sun poured its scorching beams upon the black rocks around us, and heated the air to an insufferable degree, I could not help stopping for some minutes to gaze upon the scene, and to admire the remarkable strength of the position.

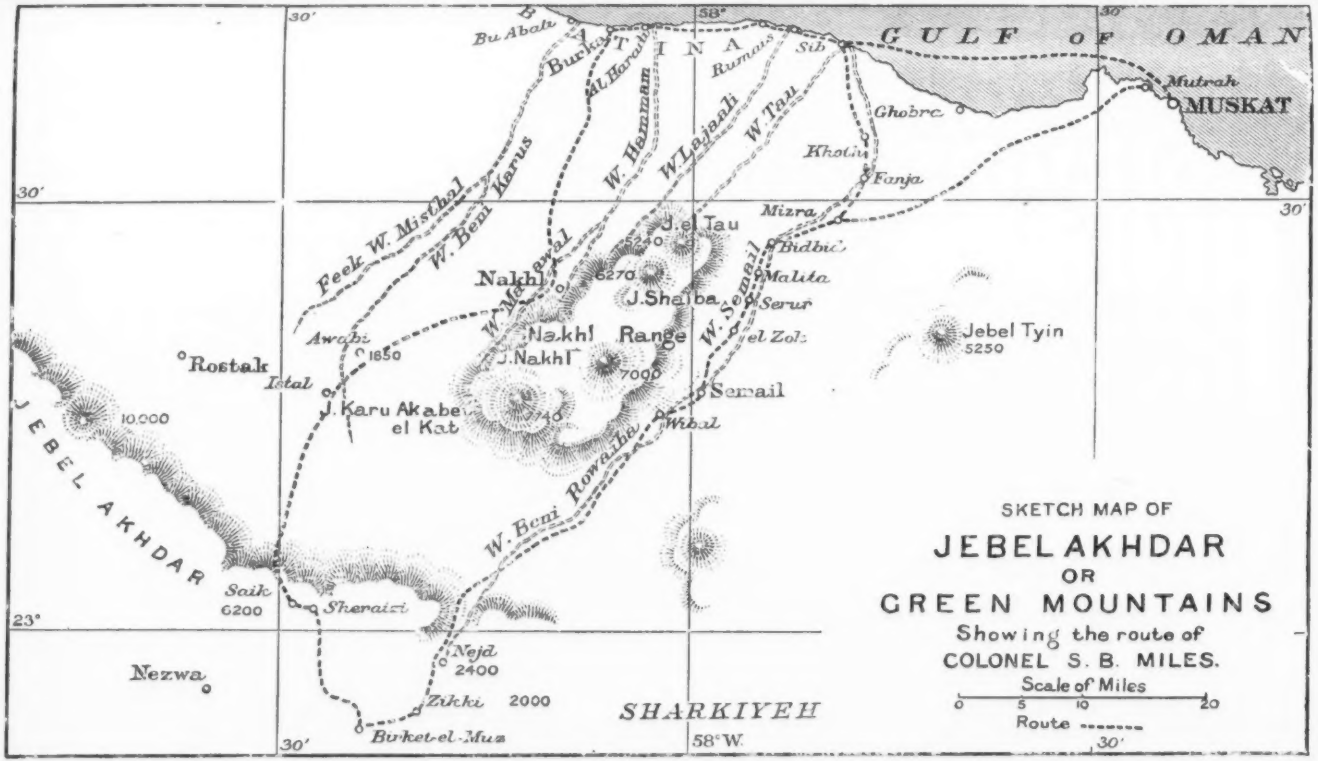
I was very cordially received by the Waly, or governor, Sezzid Salim bin Khalfan, who came down to meet me and conducted me to a small house in a pretty garden that had been prepared for me, and for the use of which I was indebted to the courtesy of one of the Sultan's officials. Here I was detained three days by the dilatory habits of the Arabs, and then, having received letters requiring my presence at Muskat, I returned thither by the shortest route. A week later, July 9, I started again, accompanied this time by Mr. Maguire, the B.I.S.N. Company's agent, and, taking a direct course, we made our first stage at the village of Halban, not far from Jebel Tau, the abutment of the Nakhl range, where we camped for the night. We found Halban a place of unusual industrial activity, the people being busily engaged in the manufacture of indigo dye from plants extensively cultivated in the neighbourhood. It is prepared in large earthen jars, and the dye is used to give the imported textile fabrics of Manchester that dark blue colour so highly favoured and almost exclusively worn by the women of Oman of all ranks and conditions. In the evening we inspected the village school, which was near our camp, and was held in the open air like an Indian pâtshâla, the sacred peepul being here represented by a large mango tree. The pedagogue was an old moolla, rod in hand, and among the twenty-one children sitting at his feet we counted five girls, one of whom was learning to write. Among the crowd of visitors that came to see us was the Sheikh of Al Tau, who pointed to his town in a west-south-westerly direction, and gave us a pressing invitation to visit it, saying it was three times as large as Halban. The next day, skirting the base of the mountain, we rode on to Nakhl, crossing numerous nullahs or ravines, and passing two villages, Farah and Lajaali, on the way.

The houses at Nakhl are built of sun-dried bricks or stones plastered over; many are high and spacious, and, though with but slender pretensions to architectural beauty, not destitute of exterior decoration. The lintels are often carved, and the doors ornamented and strengthened with pointed iron knobs or bosses. The windows are never glazed, but are closed at night with strong wooden shutters, and are sometimes furnished with mashrabiyehs, sometimes protected by strong iron cross-bars. The interiors are badly planned; the stairs are narrow and steep, and the upper apartments long and narrow. Plaster or cloth

ceilings are not in vogue, but the teak beams and rafters are often handsomely carved or painted in various devices. The windows are usually placed very low, so that the occupants reclining on the floor may look out of them, and at the top of the room circular holes in the wall serve to assist ventilation. On the floor are carpets or mats and cushions, but other furniture is scarce, and tables and chairs, of course, not to be seen. Strong wooden brass-bound boxes are the receptacles for apparel and valuables; and round the room are ranged broad shelves, on which is displayed a quaint and wondrous assortment of cuckoo clocks and other timepieces, coffee-pots, china figures and ornaments, English and Indian toys, and a variety of other curios, highly valued by their owner. In this ardour for collecting, as well as in the style of house decoration, Persian taste is very perceptible. Most of the houses have a small garden attached.

A noticeable fact here, it may be observed, is the mixed character of the population. This comprises, besides Arabs, Persians, Negroes, and Zattut, a very large proportion of Bayâsir, a race supposed to have emigrated originally from Hadhramaut. The Bayâsir are an industrious and peaceable folk, and many of them are wealthy, but are held as aliens by the tribal Arabs, and are never entrusted, I believe, with positions of authority and command. When a Bayâsir happens to meet a sheikh on the road he will not go up to kiss hands and give salutation without first dropping his sandals by the side of the path, after the manner of servants and inferiors.

Nakhl is abundantly supplied with water, and, indeed, one of the most characteristic features in its physical aspect is the existence of copious thermal springs, the medicinal virtues and efficacy of which are famous in the land. The chief fountain, or rather group of fountains, is called Hammam Thowâreh, and lies at the head of the ravine, a little distance from the town, among fragrant gardens and shady palms and mangoes. The sight is very curious. In the midst of a numerous family of smaller springs, the father of fountains gushes up out of a cavity in the ground, apparently about 6 feet in depth and 2 in diameter, and pours forth a volume of water, roughly calculated by me at 200 gallons per minute. This is the hottest, as well as the largest, spring at Nakhl, and has a temperature, I found, of 106° Fahr. There are at least twenty other springs in its vicinity, yielding altogether a very bountiful supply, but the temperature of those I tested did not exceed 104° Fahr. They are all tasteless and inodorous. On the other side of the town is a similar assemblage of springs called Hammam Odaisee, the most prolific of which issues from a hole in the rock and is led into a tank, from whence it flows to irrigate the fields. This spring was 105° Fahr., and another near it was 102° Fahr. Notwithstanding the high repute and universal belief in the curative properties of these waters, I did not observe, either here or at Thowâreh,


GULF of OMAN
MUSKAT
Mutrah
Ghobra
Fanja
Khoktin
Mizra
Bidbid
Malita
Serur
el Zoh
Jebel Tyin
5250
Sib
Rumais
Burka
Bu Abali
Al Harub
W. Hammam
W. Lajaali
W. Tau
Feek W. Mistbal
W. Beni Kerus
W. Mighewal
W. Semail
J. el Tau
Nakhl
6270
J. Shelba
Nakhl Range
J. Nakhl
7000
Awabi
1850
Rostak
Ital
J. Karu Akabet el Kat
7740
Semail
Wbal
Rowaibe
W. Beni
JEBEL AKHDAR
10,000
Saik
6200
Sheraizi
Nejd
2400
Zikki
2000
Nezwa
SHARKIYEH
Burket-el-Muz
30'
58°
23°
58° W.
SKETCH MAP OF
JEBEL AKHDAR
OR
GREEN MOUNTAINS
Showing the route of
COLONEL S. B. MILES.
Scale of Miles
0 5 10 20
Route

any facilities for bathing, such as are to be seen at Bosher, although the local faith is that hygienic effects can be more rapidly and permanently obtained by ablution than by taking the water internally. The supply of water is sufficient not only for the domestic requirements of the people without the need of wells, but enough and to spare for the irrigation of the gardens, fields, and date-groves of the settlement. The natives assert that the heat of the water decreases in summer weather and increases in winter, and they have a firm belief that the supply is unvarying and inexhaustible. The rivulets issuing from these hot springs abound in little fish, even where the water is still warm; they are about the size of minnows, and are of two species.

Mechanical ingenuity is not the forte of the Arab, and I was somewhat surprised to find, in one of the streams near the path, a flour-mill turned by water-power. It was rather a primitive and diminutive affair, but it was the first thing of the kind I had then seen in Arabia, though I have since noticed similar ones near Rostak. The mill consisted of a circular upper stone, bevelled up to a thin edge, revolving upon a stone floor, and attached below to a vortex wheel, which was set vertically with oblique floats or blades. The grain was put in unhusked, and appeared to be ground very slowly.

The castle is built on an eminence overlooking the town, between Jebel Laban and the pinnacle rock, the ascent up the ramp to the main gateway being very steep. This gate leads through a strong outer rampart pierced with embrasures and armed with a battery of iron guns mounted on rickety carriages, and, passing this, you find yourself in the courtyard, in which stands the keep, consisting of a high curtain flanked by two towers, from whose lofty battlements a superb view is presented towards the coast. It has three gates, and is in rather a dilapidated condition. Standing within the gorge and protected by the heights around, the castle is well placed, and is considered invulnerable by the Arabs, who have a deep sense of its military importance. Owing to its position, Nakhl has indeed played a by no means insignificant part in the history of Oman during the past three centuries, particularly in the closing years of the Yarebeh dynasty, and has sustained many sieges. The ruins of two other forts are to be seen here, one on the north side called Jeneb, dismantled by Sezzid Saed bin Sultan, and, after being repaired, was finally demolished by Sezzid Azzan in 1868; and another which stood near Thowâreh, and was razed to the ground by Sezzid Toorkee in 1874. Enfolded in the iron embrace of the deep gorge in which it lies, the town is shut in on all sides, and, occupied as the confined space mainly is with palms and houses, there is little room left for cultivation. The town has a regular and well-supplied market, and is divided into five quarters, viz. Atik, Hadhain, Safrat el Ijal, Khoryeh, and Hujret el Kurein. The date trees are extremely prolific, and the fruit is esteemed of superior

sweetness and lusciousness—virtues which are ascribed by the people to the copious and constant irrigation of the plantations.

Out of a population of about 6000 the pure Arabs do not exceed 1500, representing the following tribes: Yaarebeh, Harrâs, Beni Kharus, Sereeriyin, Al Khozair, and Hadhârim. The number of fighting men is 800, mostly Bayâsir. In the lower classes there is much admixture of Persian blood. Each hâra or quarter of this town had a "sablah" of its own. This institution is very popular, and consists of a small shed, or covered platform, raised above the ground and open on all sides; it may be 15 or 20 feet square, with a light roof of mats and palm leaves resting on wooden posts. I have seen some, however, more substantially built, and bearing some resemblance to a mosque. Situated centrally in the village, it forms the council hall where the sheikhs and leading Arabs assemble daily to discuss local politics and chat over the events of the day. The tobacco-pipe of Turkey and Persia being almost unknown in Oman, the inevitable coffee-pot is in full requisition, and the sheikhs' slaves may be seen close by busily engaged in roasting, pounding and cooking the berry for the company.

There are numerous hand-looms at Nakhl, in which coloured lungies and puggrees are woven, as well as cotton cloth of the natural brown variety called "khodrung." The blue yarn required is dyed here, but the red and yellow yarns are imported from Bombay. Embroidered silk belts for ladies are also made here. Another industry is the production of porous earthen vessels for cooling water, the quantity made in the Nakhl factories being almost sufficient for the home demand. The clay used is a bluish marl, brought from the neighbouring village of Musalmât, mixed with sand. The kalib, or potter's wheel, has two discs, the lower one, which is called "raha," being turned by a treadle. The clay to be moulded is placed on the upper wheel, and is fashioned by an iron instrument called "moshal," the finishing touches being done with a sort of comb called a barit.

During my stay I visited some of the schools, of which there are five here, and saw the children imbibing instruction in the usual Moslem style, repeating aloud sentences of the Koran or rules of grammar read out by the mollah. They attend in the morning, and may be seen at an early hour hurrying to school, boys and girls together, some with a "minfa," or wooden Koran-stand, on their heads, some with a painted board or camel shoulder-blade, on which they learn to write, under their arm. The instruction given is of a very elementary character—reading, writing Arabic grammar, the Koran, and a little arithmetic being the only subjects. But the boys of the learned and wealthy are often educated at home by a mollah, and advanced further. The lack of method is partly compensated for by the precocity and tenacity of memory shown by the boys. Nakhl deserves attention for the comparatively advanced state of education

among the people, there being a larger proportion of persons in this town able to read and write than in any other in Oman. There is a good number, also, of professional scribes. Books, consequently, are not so scarce here as elsewhere. The higher position of learning here is attributed to the influence of the Persians, who occupied this part of the country during the time of Nadir Shah.

Nakhl has, for the greater part of the year, a temperate and pleasant climate, being preserved from the scorching winds that sweep over the great desert, and partly shaded from the sun's rays by the impending mass of mountains to the east and south. It is, moreover, cooled and refreshed by the sea-breeze from the coast; but we found from personal experience that the heat, though dry, could be sometimes stifling and oppressive in the extreme. The elevation, taking the mean of two aneroids, is 1100 feet.

On July 11 our kafeer, Sheikh Selim, having intimated that he had procured an escort, and that he was ready to conduct us to the foot of the pass, we mounted horses and left Nakhl at 3 a.m. the next day. Our route lay along the Rostak road, which, following the sweep of the range, led us west by south over a barren country with an intricate system of low hills, ridges, and ravines. Some of these ravines are inhabited by warlike tribes, and it may be convenient here to give the names of these ravines as they occur in succession from Sib westward. The first of them is the Wady Tau; the second is the Wady Lajaali, also called Wady Halban, and having its exit at Romais; and the third is the Wady Hammam, or Nakhl, which joins the Wady Maawal, and reaches the sea at Al Harâdi. The fourth river, the Wady Beni Kharus, becomes a confluent in its lower course with the Wady Misthal, and flows into the sea at Bu Abâli. The Wady Misthal belongs chiefly to the Beni Riyam, who occupy Fik and three other villages.

Soon after leaving Nakhl we pass to our left Towye, a hamlet lying at the foot of the Akabet el Kat, a rugged way, little better than a goat track, but the only one over the range to the Semail valley. At 8 a.m. we reached Felej el Khosair, in the Wady Beni Kharus, where we dismount for breakfast, while the sheikh trots on to Awabi to make various arrangements. This little dell is highly cultivated, and produces an abundance of fruit and vegetables. The fragrance pervading the air from the shrubs and sweet-scented herbs was very pleasant and enjoyable.

Leaving Felej el Khosair at 4 p.m., we rode on for two hours till we came to Towye Saib, a hamlet of the Dahaul Arabs, where the ravine suddenly expands into a small plain three-fourths of a mile in extent, and a mile beyond this we reach El Awabi, where we halt. The wady here turns sharp to the left through a deep and narrow defile, and at this point on the left bank, completely commanding the passage, stands

the castle Bait Awabi, in a position of great natural strength. Commanding the most accessible pass up Jebel Akhdar on the north, this fort has ever been a bone of contention between rival chiefs and factions. In particular it forms a constant source of trouble and hostility between the Ibriyin and Beni Riyam tribes, the former holding possession of it, while the latter would like to destroy it. Shortly before my visit the fort had been attacked by the Beni Riyam, who had mauled it very considerably, without, however, effecting a capture. One of the towers, I noticed, had been almost levelled to the ground. At one time the Ibriyin, fearing a strong coalition against themselves, offered Bait Awabi to the sultan, Sezzid Turky, who declined it. Subsequently His Highness changed his mind and asked for it, but in the mean time the tribe had changed their minds, and refused to give it up. It was eventually purchased by the sultan for a large sum, and the transit dues, which had been previously levied by the Ibriyin on goods passing through the defile, were then abolished.

Awabi lies about halfway between Nakhl and Rostak. The settlement covers a fairly large area, and every available spot has been reclaimed for tillage. The wheat and jowari had just been reaped, but other crops were still standing, and the fields, kept neat and regular, bore witness to industry and good husbandry. Stall-fed cattle of the small humpbacked kind are numerous, and almost every house appeared to have a cow or two. They are fed on barley, dates, and lucerne; and, though there is plenty of coarse grass, they are not allowed to roam about the hills. Awabi has a population of about 2000, with a fighting strength of nearly 400. It is occupied by three tribes, viz. the Beni Kharus, Ibriyin, and El Harras, who appear to dwell together amicably. The headman of the town, Sheikh Jabir, was very attentive and obliging, but was not very communicative. He was much depressed by the chastisement recently inflicted on his people by the Beni Riyam, and pointed out to me, sadly, the havoc they had committed among the date palms, the prostrate trunks of which were lying about in hundreds.

The shoran or bastard saffron plant grows plentifully in these hills, and the dried flowers are used by the women, who generally go about unveiled, to daub their own and children's faces with. It stains the skin yellow, and does not improve their appearance, though perhaps they think otherwise. The ladies who can afford it employ true saffron for the same purpose.

The preparation of dried dates, known in Oman as "bisr," and in India as "kharak," is carried on largely at Awabi, and as the season had now commenced, I took the opportunity to observe the process, and was taken round the factories by the sheikh. The dates selected are almost exclusively of the "Mubsili" and "Khanaizi" varieties, and are picked before they are quite ripe. The factory had a chimney about 15 feet high, and contained several open, circular, copper boilers,

capable of holding five gallons each, and nearly full of water. Into these vessels the dates are put, and allowed to simmer over a slow fire. As the water in the copper decreased from evaporation, it was filled up again, but it gradually became inspissated by the extraction of the juice of the date. The fruit is left in the water about half an hour, and is then taken out and spread on mats or cloths in the sun to dry, after which it becomes hard and of a pale red colour. It is exported in large quantities from Muskat to India. We were here transferred to a new escort, part of our old one returning hence to Nakhl, and camels were here substituted for horses, as being better suited for rough hill work, and the gradient between this and the next stage being very severe.

After leaving Awabi, the elevation of which is 1850 feet, the next morning we were led past the fort in a direction generally tending south-west, the tortuous ravine gradually narrowing to a cleft with perpendicular sides 600 to 800 feet high, and though evidently swept occasionally by impetuous torrents, pleasantly fringed, and adorned in places with rhamnus, tamarisk, oleander, asclepias, and other trees and shrubs that have clung tenaciously to the ground and withstood the rushing waters. At two and a half hours, 6 miles from Awabi, we come to Istâl, a village of the Beni Kharus; and a little further on a heap of ruins on the right bank above us, indicating the site of an ancient castle, named Hisn Salut, is pointed out. This fortlet, which was finally destroyed less than half a century ago, in one of the many tribal wars for the possession of this defile, had a chequered history, and as we passed it the Arabs of my party had a lively discussion on bygone events associated with it. The formation, as disclosed by the Wady Beni Kharus, appeared to consist, at first, of an argillaceous slate, giving place, as we ascended, to a dark sandstone variegated with reddish or brown streaks, the stratification being sometimes confused and dipped at great angles, sometimes crumpled by pressure, and apparently metamorphic.

Opposite the village of Istâl is a curious high ridge with a serrated crest, called Ikhbal. Above this the structure changes, limestone predominates, and a pleasing transformation takes place in the scenery, the hills assuming a verdant appearance that was denied to the lower slopes. In this part of Oman many of the wadies are cut through conglomerate, which usually forms the bed, and the Wady Beni Kharus is no exception to this rule.

Between Istâl and Aleya we passed six small hamlets occupied by shepherds and mixed tribes, owning large flocks of goats. At Aleya, where the aneroid barometers showed an altitude of 2400 feet, we dismounted and halted in order to begin the real ascent of the mountain about nightfall, the sun's rays at this season of the year forbidding any attempt at alpine climbing in the heat of the day. It was destined,

however, that I should traverse the mountain alone, as during the afternoon a kosid arrived with the post-bag, and my companion received letters recalling him to Muskat on business. He was accordingly obliged to relinquish the design of coming with me any further, and it was arranged he should return to Muskat the next day. The rugged conformation of the mountain sides here is picturesque, but the area available for cultivation is very limited, for the space is confined by the intersecting ravines that furrow the slope.

As may be naturally supposed, the ground has not been reclaimed without considerable difficulty and labour, the inequalities of the surface in some places necessitating the fields and orchards being raised and banked up. The soil is very fertile, and the earth is merely scratched by the plough, which is small, light, and simple. I saw a man turning up the stubble with a plough drawn by a single bull. The ears of corn are cut off close, and are threshed with flails made of date-stalks. Fruit grows here in profusion, and we noticed the citron, vine, lime, orange, and other kinds. A few coffee plants may be seen here, and it is the only place in Oman where it still lingers, the flourishing plantations that formerly existed having now all disappeared.

The sheikh informed me in the evening that he had made an arrangement with the owner of six asses, just arrived from above, to take us to Nezwa for fifty dollars, and to this I willingly agreed; but as six animals were not nearly sufficient for our requirements, and as no others were procurable, we had to hire porters to carry up the rest of the baggage. The sturdy Arabs who are accustomed to do this work, carry the burden on their backs in a net supported by a band or rope across the forehead, and seem to think little of their performances.

It was a little after midnight on the 13th that, after taking leave of my companion and of the sheikhs who had so obligingly conducted us thus far on the journey from Nakhl, I commenced the ascent of the Akabat el Hajar or Lhojar, as it is popularly termed. It was quite dark as we began the ascent of the precipitous mountain in front of us, up a rugged watercourse, and I wondered how the Arabs could see their way along the narrow path. At times we had a stiff climb, and zigzagged up the acclivity at a perilous angle; at other times the track was less steep and easier. As we leave the torrent bed and continue to progress upward, the gradient becomes much more formidable, and the mountain now presents sheer perpendicular cliffs and bold buttresses. The path would be here quite impassable for beasts of burden had it not been artificially improved by the construction of successive series of rough steps formed of huge slabs of stone, and by the curbing and revetting up of the road in parts where it overhangs a precipice. The stupendous nature and difficulty of the work and the skill and enormous labour bestowed on it claimed my wonder and admiration, but it was in vain that I endeavoured to gather any local tradition respecting

its origin. The absence of tradition and the character of the work led me to regard it as of Persian conception and execution. A scattered Arab tribe like the Beni Riyam, always at war with its neighbours, could not have done it, and I think the most probable period to which it can be assigned is that of the Dailemite conquest of Oman in the tenth century of our era.

We found the asses we had hired of the hillmen to be surprisingly strong and sturdy animals; they were as surefooted as mules, and so active that they performed the ascent, a toilsome climb of 5000 feet, in five hours without exhibiting much fatigue. Unlike any others I had seen, these creatures were more stoutly built and much more spirited than their humble kindred of the plains. Their owners seem to treat them well, and do not, I believe, take them beyond the foot of the mountain. It is said that these asses are descendants of domesticated animals that have run loose in certain localities, three of which were mentioned to me; the asses in these colonies are probably in much the same half-wild state as the ponies in the New Forest and on Exmoor. Where the nature of the path permitted, the one I rode was accustomed to make short and rapid spurts, and then stop to regain breath. It was an impetuous, vicious little brute, always trying to bite somebody, and had acquired in consequence the name of Dheyaib, or the "Little Wolf." The saddles used are heavy and clumsy, and the load put on them appeared to be almost as much as a mule would carry. Owing to the sharp hard rim and deep cavity of its hoof, the ass is well fitted to climb rocky hills, and its value to the Arab in this mountainous region is great.

After about five hours of incessant toil, we reached the summit of the pass as the sun rose, and my weary party camped by the side of a little rill for two hours for rest and refreshment. I could have enjoyed a longer stay, as at some points it was possible to obtain a glorious panoramic view of wild and majestic scenery. We were here standing on one of the highest ridges of the mountain, and the escarpment, as it appeared to us, dropped almost perpendicularly from crag to crag, sheer to its base; the sea, though far distant, appearing from the dizzy height to be close under us. I found that one of my aneroids had given way during the ascent, but the other, graduated to 10,000 feet, was all right, and showed we had attained an altitude of nearly 8000 feet.

On resuming our journey, we descended for some distance a gradually shelving and undulating grassy plain with many large trees, which, however, were too far off to be recognized, and then came to a broad and verdant vale, which intersected our path and led away to the south-west. We saw a few shepherds tending their flocks in the distance, but the only wayfarers we met on the road were a party of women carrying bundles of grass on their heads for their cattle. After travelling in an east-south-east direction for 10 or 11 miles, we dismounted at a small

mosque and grove of trees by the wayside, and while resting here were joined by some of the sheikhs of Saik, Mohammed bin Saed and others, who had come out to welcome us and escort us to their town. The temperature at this spot at noon was 85° Fahr. in the shade, and there was an exhilarating and bracing freshness in the air truly delightful. From this point several high peaks were visible, but there was no village nor sign of human habitation near.

In the company of our new guides we now moved on again, and, passing on the way the spring and felej that supply Saik with water, we found ourselves, on turning a corner, suddenly brought to a stand on the very brink of a yawning chasm, dropping vertically to a depth of 400 feet below us, and effectually barring our progress. I looked about wonderingly, when the sheikh, taking me by the arm and pointing to a white village with a pretty green setting, lying in a sequestered nook at the foot of the cliff, said, "There is Saik; I will show you the way down to it." It was certainly the most singular situation for a settlement I ever beheld, and the mode of access to it was not less remarkable. Steps cut in the rock led to the bottom of the cliff, and down this long and slippery staircase my little steed tripped nimbly and steadily, but I was not sorry when we reached the ground. The whole community was there to receive us, and quarters were assigned to me in a small house that was vacant, while my party camped in an open space outside the village. This curious cluster of houses has a population of about four hundred, who subsist by growing corn and fruit, and exchanging their surplus produce for dates, cloth, hardware, etc., for they have no manufactures. They have many wells, and have also a small felej to irrigate their vineyards, fields, and orchards.

The cereals are wheat and jowaree, and two crops are gathered in the year. The rose, myrtle, and jasmin luxuriate in the gardens. Strong but rude trellises support the vines, which were still very abundant, though they were said to have much decreased of late years from blight or phylloxera. This misfortune is attributed by the natives to the machinations of an Afghan, who, about twenty years previously, had endeavoured to preserve grapes by adopting the Kabul method of packing the fruit in cotton-wool. A consignment was sent to the Zanzibar market, but the venture did not prove a success, and the attempt to start a trade in boxed grapes was abandoned. A year or two later the vines happened to be attacked by disease, and the people sagely concluded that the Afghan had cursed their vineyards after the failure of his speculation.

After receiving and dismissing a crowd of visitors, I went in the afternoon to pay a return visit to Sheikhs Nasir and Suliman, sons of the old temeemeh or chieftain of the Beni Riyam, Saif bin Suliman, by whom I was cordially received and regaled with coffee and conversation. They took me over their house, which, though the largest in

Saik, is an unpretentious structure, two stories high, built, like the rest of the houses at Saik, of stone cemented with yellow clay, and surrounded by a pleasant orchard and garden. I had hardly returned to my cottage, after visiting the sheikhs and taking a walk through the town, when a violent thunderstorm with hail and heavy rain burst upon us and lasted for some time. The rain on the rocky plateau above soon concentrated in the watercourses, and the tumultuous cascades that began to tumble down the steep walls of the chasm afforded a fine spectacle. The people informed me they had already had several smart showers, and that there was generally a fair amount of rain during the monsoon.

At 4 p.m. to-day the thermometer stood at 82° Fahr., at 6 p.m. it was 80°, and at 10 p.m. 74°. I found the elevation of Saik to be 6200 feet. The word Saik in Arabic signifies "a cleft or chasm."

This was the first point in the interior at which I had touched the route of Lieuts. Wellsted and Whitelock, and, having made inquiry as to whether there was any remembrance of their visit, I was gratified to meet with some who had personally witnessed their arrival forty-two years before. At my request, Sheikh Mohammed sent for two old men of the village and brought them to my cottage. I found that they retained a clear impression of the event, and their statements amusingly indicated how narrowly the strangers had been watched. The Arabs remembered that the officers had tents with them, used brass instruments to gaze at the sun, and spent much of their time in writing. Among other objects of wonder and curiosity, it had been noted that they possessed a bottle full of snakes.

The sheikhs of the Oman tribes have, in general, but little power over the other members in time of peace, but the temimeh of the Beni Riyam may be regarded as an exception, and he is indeed, from this and other causes, one of the most prominent sheikhs in the country. He is seldom on good terms with the Sultan of Muskat, and defiantly appropriates to his own use the produce of the Bait el Mal or crown lands, which belong of right to the ruler. In connection with this family, I am sorry to have to record one of those domestic tragedies so common in Arabia. Sheikh Nasir bin Saif died a few years after my visit, leaving three sons, the eldest of whom, Mohammed, inherited his father's position as temimeh. In 1886 Mohammed and his second brother were murdered by their uncle Suliman, who usurped authority and held it until 1899, when Nasir's third son retaliated and put his uncle Suliman to death.

The Beni Riyam occupy the towns of Sheraizi, Saik, Nezwa, Zikki, Birket el Muz, and Tanuf, and number about 17,000, of whom 3000 are fighting men. The tribe is Himyaritic and of Kamar origin, its eponymus being Riyam bin Nahfan bin Tobba bin Zaid bin Amr bin Hamdan. Their ancient domicile was in the province of Hamdan,

in the Yemen near Jebel Atwa, on the summit of which, where fire issued from the ground, was the temple of Riyam, a fane of great sanctity with idols of the sun and moon, and a great resort of pilgrims. According to the Arab geographer Hamdani, the ruins of this temple were still to be seen about the year 950 A.D. Tradition relates that the Beni Riyam emigrated in remote times from the Yemen, in company with their cousins the Mahra, and marched on to Oman, leaving the Mahra on the way, in the land they now occupy. After crossing the peninsula, the Beni Riyam were fortunate enough to secure as their new habitation a vantage-ground in the most inaccessible and central part of the country, and called the mountain, after the name of their old capital Radha, Jebel Radhwan, since changed, when or why I know not, to Jebel Akhdar. The fire temple seems to have passed out of the memory of the tribe, who now regard Radhwan as the name of an ancient prophet that arose among them. A portion of the tribe is said to derive its descent from Malik bin Fahm, who invaded Oman in the second century after Christ.

On the 14th I moved across to Sheraizi, which lies a mile to the eastward, and was received by the headman, Sheikh Salim bin Abdulla, whose present was a basket of peaches. The town is much larger than Saik, and offers a most striking contrast to it in the position it occupies. Though less quaint and romantic in appearance, Sheraizi is more favourably and finely situated, being perched near the head of a ravine, like an eagle's nest, on the brow of a lofty cliff which falls rapidly to the valley beneath, commanding an extensive prospect. The town is built on so steep a declivity that the houses appear to overhang one another, and the only communication is by means of narrow, dirty, irregular steps leading up and down from one row to another. The houses are small and mean-looking; they are constructed of stone, and are sometimes, but rarely, plastered with clay on the outside, as at Saik. Just under the town there is a copious spring of pure water, which gushes from the rock to fill a circular cistern, sufficing for the requirements of the inhabitants, and serving the conduits that fertilize the terraces below.

I spent most of the day in wandering about the place and examining the extensive hanging gardens which are spread along the precipitous valley walls and form the most interesting and beautiful characteristic feature at Sheraizi. To the left of the town, beneath it, and on the opposite slope of the valley, the whole face of the hillside, to the depth of 1000 feet or more, is cut into a parallel series of ledges or terraces, most symmetrically arranged and highly cultivated as vineyards, orchards, and cornfields. These curious pensile gardens, the like of which I had never seen before, with their varied foliage and ripening fruit, apricots, grapes, figs, and pomegranates, formed a very attractive and pleasing sight, and had evidently been most carefully constructed,

the terraces being stepped up with revetments wherever the natural features of the ground had not availed, to maintain the earth in position. Owing to the sharp angle of the slope, the ledges are in general very narrow, perhaps 10 or 12 feet in width, and considerable ingenuity has been displayed in their disposition and in overcoming the difficulties of the ground. The labour bestowed on them, however, would have been futile without an abundant supply of water, and in this respect nature has been prodigal, the cultivation being easily and perpetually irrigated by the numerous mountain streamlets, which are taught to meander from one ledge to another in turn, being confined by little embankments along the margin. Extensive as these terraces appear, the space they cover is not very large, and the inhabitants would be glad of more soil. The limited scope for tillage necessitates economy, and the corn may often be seen intergrown with leguminus, and sometimes even with melons and other cucurbitaceous plants.

Opposite the town, and on the other side of the intervening valley, which is called the Wady Miyadin, and flows to the south-south-east, is a conical hill with a ruined tower and mosque on the summit; and to the right, lying south-east by south, is El Jabul, a curious peak, which, I was told, was looked on as a potential stronghold, having served as a refuge for the tribe in old times. It is now untenanted, and no vestiges are left of ancient buildings. It is capable of easy defence, as the path leading up it is so steep, narrow, and rugged. The scenery of this valley, with its regular and richly varied terraces, like giant steps on the mountain-side, is as beautiful as it is extraordinary, and of a character of which it is impossible to give an adequate idea.

In the afternoon clouds again gathered round the peaks, and we had a pelting thunderstorm, which was very grand; the lightning was very vivid, and the cataracts of water seemed to gratify the Dailemites immensely.

The women here, and throughout the valleys of Jebel Akhdar, fetch water for domestic purposes in large copper vessels instead of in earthen jars, as in other parts of Oman. They also use copper cooking-pots almost exclusively, the employment of this metal being due, no doubt, to the difficulty of bringing earthenware up from the plains, and to the absence of clay in these mountains suitable for good pottery. The hillmen procure these vessels from Nezwa, where I afterwards found the manufacture of copper ware to be one of the principal industries.

During our ascent of the Akabet el Hajar to the plateau, the change in the character of the vegetation had been complete, marking the difference of elevation by the substitution of that of the temperate zone for the tropical and subtropical verdure of the plains. The plantain, the mango, and the stately date palm, which forms such a conspicuous feature in the scenery of Arabia north of the eighteenth parallel, and

which we last saw in the Wady Beni Kharus, have all disappeared, and in their place we have the walnut, pine, apple, and pomegranate. The fig, peach, apricot, vine, almond, and lime also flourish. M. Aucher Eloy mentions the cherry, but I did not observe it. The pomegranate is a handsome shrub, with dark green foliage and crimson flowers. It receives more attention at Sheraizi than any other product except the vine, and the fruit, though small in size, is of superior excellence. It forms the chief item of export from Jebel Akhdar, being shipped from Muskat to the value of 10,000 dollars annually for the Bombay market. The Arabs are very fond of the pomegranate, and employ it for making sherbet. The rind is very astringent, and is used medicinally as a febrifuge and anthelmintic. The terraces appeared to offer a peculiarly suitable site for growing coffee, and it was once extensively grown here, but from some cause the plantations failed, and the plant has now entirely disappeared.

I need hardly say that the assumption as to the nutmeg growing in these hills is erroneous, Wellsted's mistake having probably arisen from the name this spice bears in some European languages. Mace, the arillus or covering of the nutmeg, is another word indicating the belief prevalent in old times that Oman was the habitat of the spice, it being derived from Maceta, the appellation given to Cape Mussendom by the Greek geographers. Like so many other articles still bearing Arabic names, *e.g.* sugar, pepper, olibanum, rice, etc., the nutmeg was introduced into the Mediterranean by the Arabs.

The vineyards at Sheraizi are very extensive, and are regularly irrigated and manured. The vines are trained on rough trellises at certain distances, and produce both varieties of fruit, white and black. The grapes, which ripen here in August, were hanging in goodly bunches, and it did not seem to me that the people had any reason to complain of the crop, but they grumbled a good deal. Although much of the fruit may be eaten, and a portion made into raisins, there can be no doubt that the bulk of the crop is intended for the manufacture of wine of an inferior kind, which is entirely reserved, I believe, for home consumption. I did not, of course, witness the process, as it was too early in the season, and I had no opportunity of tasting the vintage, but I should imagine it, from the description I heard of the method employed, to be far from satisfactory. After crushing the grapes and mixing water with the whole mass of pulp, juice, skins, etc., they leave the liquid for about three weeks to ferment. The wine thus made is considered fit to drink in about three months after the fruit has been plucked. The wine thus made is consumed in the long winter evenings by the Sheraizi men, whose wine-bibbing propensities are notorious and reprobated throughout Oman. The Arabs of the interior, being a temperate and abstemious race, regard the constant manufacture of wine in their very midst by these Persians as a scandal

to their religion, and do not permit the production of spirituous liquor in any other part of the country, so far as I am aware.

Jebel Akhdar was explored botanically to some extent in 1836 by M. Aucher Eloy, the intrepid and indefatigable French naturalist, who ascended the mountain by the Akabet el Hajar, and returned to Muskat by the Wady Semail. In his zealous and enthusiastic search for plants, he traversed the greater part of his journey on foot with infinite toil, reaching the coast again at last enriched with many specimens of new species, but weary, fever-stricken, and footsore. In his journal, which was edited by M. Jaubert in 1838, he gives a graphic account of his sufferings and adventures. M. Aucher Eloy tells us he found many pretty flowers well suited for introduction into Europe; he collected about 250 species, and reckons there may be 500 altogether in Oman, an estimate which will, I suspect, be found much below the mark. In the vicinity of Nakhl the botanist found a tree of the genus Niehburia, and a very pretty flowering shrub, which he named *Vogelia leprosa*, also a beautiful new Dichyptera. The vegetation on Jebel Shaiba, the altitude of which is 6270 feet, was new to him. At El Hajar was a new Bohravia, and at Aukaud a new violet, a new genus of primula, and a new species of Lunius, which he named *Aurea*. At the dispersion of M. Aucher Eloy's collection, the Kew Herbarium took 2600 specimens, and the British Museum 1907.

This mountain is estimated by Lieut. Wellsted to have a length of 30 miles from east to west, and an extreme breadth of 14 miles from north to south. The highest point visible from the sea was reckoned by the nautical surveyor at 9940 feet, but I have not been able to ascertain the local name of this peak with precision, some Arabs giving it as Jebel Hauz, some as Jebel Shum. The abruptness of the north and south sides render this grand rocky mass inaccessible from the plains, except by means of the torrent beds that ages of surface drainage and the waters of living springs have scored in its rugged flanks. Three of these natural highways leading to the summit can be travelled by animals with burdens, and form, consequently, the main passes. On the north side the Akabet el Hajar has been already mentioned as the one by which we ascended; the southern side offers two, the Wady Tanuf and the Wady Miyadin, the former being longer, but of the same character as the Wady Miyadin, which will be described further on. There is also, on the north side, the Akabet Fik, and on the south side the Akabet Shash, and perhaps others, but they are little better than goat-tracks. Eclipsed in height by a few peaks only, the northern flank of the mountain presents the most elevated ridge, and this feature is characteristic of the whole chain, which is much more lofty, abrupt, and precipitous throughout its length on its northern face than on its south flank towards the desert. The plateau declines gradually from north to south, and then falls rapidly to the plain in cliffs which, though wild

and striking, are less imposing in their grandeur than those on the seaward front. Owing to this conformation, the ravines thrown to the south by the watershed are the longest and most numerous, and drain off by the two great arteries, the Wady Miyadin and the Wady Tanuf, the bulk of the surface or rain-water that falls on the mountain. Among the tributaries received by the Wady Miyadin are the Wady Sarut and Wady Saik. The chief tributary of the Wady Tanuf is the precipitous Wady Beni Habib, in which are two villages, Ain and Akr.

To two or three only of the peaks visible from Sheraizi could the Arabs give names; they pointed out Jebel Hauz, a few miles to the south-west, and Jebêl el Ham, a tall peak to the northward. Jebel Akhdar must have been very different at the distant period when it received the appellation, then, no doubt, an appropriate one, of "The Verdant Hill," from the drear and arid aspect it presents at the present day. Though immense masses of exposed rock, destitute of vegetation, give the mountain generally a savage and unattractive appearance, there are some parts that are well wooded, and the plateau we crossed had much long grass and herbage. Many of the deep ravines, moreover, are said to possess dense thickets of thorny undergrowth and euphorbia, and the extent of cultivation at Saik and Sheraizi strengthen the conjecture that the range in former days was better clothed with arboreal vegetation. The destruction, if it ever took place, of the forests that once covered the surface of the plateau, would have given full scope to the denuding power of the rain, and the long-continued effect of this would be to wash the fertile soil into the valleys below. This would prevent the renovation of the forests, and thus we have a bare landscape instead of a tract shaded by extensive woods. Again, the denudation of trees must have caused reciprocal action in reducing the rainfall.

If any useful minerals exist in Jebel Akhdar—and the only one I noticed was iron—they are little explored and utilized by the inhabitants, who devote themselves either to agriculture, in the case of townsmen, or to rearing animals. The bold and hardy shepherds, who are by their calling sprinkled about everywhere with their flocks, number several thousands, and form the chief fighting material of the tribe. Though so widely scattered, they assemble with great celerity and promptitude when summoned by the sheikhs for war.

There is a paucity of animal-life in these hills. Wolves, hyenas, wild goats, ibex, wild cat, and leopard are said to be found; but the last named, if existing at all, is very rare. Kites and vultures may be seen circling round in the sky, but other birds appeared to be scarce, both as regards species and individuals.

Almost from the commencement of the rise of the Arab empire in the seventh century, the possession of Omen was coveted by the khalifs, who regarded it as an integral portion of their dominions; but the people

of Oman never freely accepted this view, and preferred independence, holding that subjection to the central government merely meant the payment of a heavy tribute without any corresponding advantage. The result was that for three centuries Oman became the ever-recurring scene of sanguinary conflict and devastation, and was reduced to the position, except during some fitful intervals of repose, of a tributary province of the empire. But persistent as the efforts were to effect a complete subjugation of the land, there was one part, Jebel Akhdar, that long remained impregnable and defied successively the Khalifs Mowiya, Abbas, Harun, Motadhid and Mutti, whose troops overran all Oman, except this mountain stronghold, at the foot of which they surged and struggled, like angry waves against a rocky islet, in vain. The remarkable achievement of its capture was reserved for the Buwayid Malik of Fars, Adhad ul dowla. The uncle of this prince, Muiz ul dowla, had previously, in 354 H. (965 A.D.), invaded Oman, but hostilities had then been averted by the prompt submission of Nâfi the black, who, having murdered his master Eusof twelve years before, then held power with a Turkish guard. Nâfi was left in charge as governor, but was expelled soon after by a combined Carmathian and Omani force. This revolt was followed, in 355 H., by a second Buwayid invasion under Abul Faraj and Adhad ul dowla, who ravaged the country and brought it once more to obedience. In 362 H. (972 A.D.) the Buwayid army of occupation in Oman, which consisted partly of Persian and partly of negro troops, the latter numbering several thousands, broke out into open mutiny, and threw the country into anarchy. The news quickly reached Bagdad, but the Amir ul Oomra, Izz ul dowla, was powerless to take action in so distant a province, being himself at that time in a critical position, and his cousin, Adhad ul dowla, therefore, who had long wished to annex Oman to Fars, seized the opportunity to despatch a force from Siraf across the Persian Gulf to restore order. His general, Abul Harab, defeated the mutineers in three successive battles, and took possession of the country for his master. His treatment of the inhabitants, however, was so oppressive that they were soon in revolt against him. The national gathering was so strong that the newly elected Imam Sheikh Ward bin Ziyad and his deputy Sheikh Hafs bin Rashid were able to drive the intruders back to their ships.

For the moment Oman was again free, but the dark cloud of humiliation that followed this transient gleam of liberty was more calamitous than any previous one. Adhad ul Dowla met the disaster by sending an army under his wazeer Abul Kasim al Mathhad, powerful enough to crush all opposition. The fleet sailed first to Sohar, and then moved on to Kuryat, where the Imam Ward had concentrated the Arab tribes. On the plain between the sea and the Devil's Gap a great battle ensued, and the Arabs, worsted, but not subdued, retired up the Tyin valley, pursued by the enemy to Nezwa, where a second stand was made.

This conflict, more desperate and sanguinary than the first, resulted in the destruction of the Omani force. The Imam Ward was slain on the field, and the country fell prostrate at the feet of the victors. Jebel Akhdar alone remained intact, and in this mountain fastness the survivors now took refuge. No previous conqueror had ever ventured to attack these menacing and almost inaccessible heights, but the wazir Abul Kasim felt so elated and confident that he resolved to crown his work by storming and reducing this last citadel of the Arabs.

In two divisions, up the precipitous and rugged Wady Miyadin and Wady Tanuf, the Persians fought their way in face of the Arabs, who defended the mountain by hurling down rocks, slinging stones, and shooting arrows against their eager and relentless enemies. Step by step the Persians pushed on, and step by step the Arabs retreated, fighting desperately for many days. The summit was gained at last, and the final stake had then to be fought out in the open field. In this battle, which took place on a small plain called Sherif, above the Wady Beni Kharus, the Arabs are said to have numbered 10,000, but the Persian strength is not given. The struggle was long and bitterly contested, but the despairing valour of the Omanis could not prevail against the superior arms and training of their adversaries, who, after a terrific carnage, utterly vanquished them. The Arabs' cup of humiliation was now full, and Abul Kasim's conquest of the land was absolute and complete. The women and children of the Arabs became, of course, the spoils of the victors, and many of these Dailemites or Persians, attracted by the salubrity and fertility of the mountain, resolved to settle there, selecting for their new abode a village on the site of the present town of Sheraizi, which they renamed the "Little Shiraz," after the capital of Fars. As the Persian power waned before the Seljukian Turks, and as the Arabs recovered strength and freedom, the people of Sheraizi gradually became absorbed in the Beni Riyam tribe, of which they now form a distinct and dependent section. Though they have assimilated themselves to the Arabs, during the long period of their occupation, in language, dress, and habits, and are only to be distinguished by a somewhat fairer complexion and different physiognomy, it is evident they maintain themselves as a separate community and keep aloof as much as possible from the Arabs, seldom mingling, rarely intermarrying with them, and never descending into the plains. Though they are said to be a dissipated and depraved race, they are a peaceable and quiet folk. Their industry has been concentrated on agriculture, and the elaborate work of terraces, if not originally designed, has been at least vastly improved by them. It must not be forgotten, also, that they have conferred a benefit on the country by the introduction of many valuable fruits, as the pomegranate and the vine, the walnut and the peach, and the

almond and the mulberry, most of which were brought over from Persia after the Buwayid conquest in the tenth century of our era.

Not being prepossessed with the sour-visaged people of Sheraizi, and being pressed for time, I remained only one day here, and bid adieu early on the morning of the 15th. The descent of the precipice commenced immediately after leaving the town, and I rode down the declivity, passing on the way a few hardy plants which struggled for existence at the edges of the ravine, where they derived a scanty nourishment, until we reached, at about 1000 feet, the Wady Sarut, just under El Jebûl, which rises perpendicularly from the torrent bed to a considerable height. Another steep descent of some 2000 feet down the rough and stony bed, half choked with great boulders and fragments of rock, led us into the Wady Miyadin, and, following this, we came to a village called Musaira with a small plantation of date palms, the sight of which, at such a high elevation, was a surprise. Although this pass is less precipitous than, and does not bear comparison with, the Akabet el Hajar, it has required an almost equal amount of rough engineering work, and the steps have been most laboriously and ingeniously constructed. Riding down it was no easy matter, but my steed made his way along the slippery path with great steadiness. A small but perennial stream flows along the Wady Miyadin, fed by the springs issuing from crevices in the rock. These springs appeared to be more abundant in the higher parts of the mountain. On reaching the bottom of the pass, we experienced a hot simoon wind blowing strongly up the valley from the direction of the desert. The air was most oppressive and stifling, but the thermometer only indicated 110° Fahr.

The banks of the wady at this part exhibited chiefly a dark bluish, veined limestone and a very brittle ferruginous shale. Miyadin, where we stopped for coffee, is a pretty village under high cliffs, with a felej giving a bountiful supply of water, and many date, lime, and other fruit trees. The hot breath of the simoon was here suddenly changed into a cool and refreshing current of humid air, and to this succeeded a thunderstorm with heavy rain. At 1 p.m. we were again winding down the ravine, which now presented a more gentle declination towards the south. Three miles further we came to Misfa, a small hamlet, and here the banks of the wady begin to recede and to decrease in height, vegetation at the same time becoming more abundant, tamarisk, rhamnus, palm, and acacias fringing the bed. For two hours more we rode along the gradually opening valley until, emerging from the hills, we found ourselves upon a spacious plain, now parched and dried by the burning rays of a summer sun, and with the horizon unbroken save by distant clumps of palms. Here we suddenly changed our direction and turned to the east, arriving at length at the gate of a stone-built castle, where we knocked for entrance. This castle was

Bait Rudaida, the residence of Sezzid Hamad bin Hilal, a second cousin of H.H. Sezzid Turky, and an amiable and intelligent youth of sixteen, who welcomed me in the most friendly and hospitable manner.

I was accommodated at first, after the usual complimentary interview and coffee, in a little mosque within the castle precincts, until a room had been prepared for me upstairs, our arrival here having been entirely unexpected. In the mean time I had leisure to look round and see the castle, which is of similar size and style to Bait el Felej, near Muskat. Surrounded by an exterior wall which forms the courtyard, the Bait consists of a long rectangular structure, two stories high, protected by defensive towers at the angles, and enclosing an inner quadrangle open to the air. Inside the courtyard are quarters for the garrison, and in one corner is a small mosque. If well guarded, it could well resist an Arab force, unprovided with artillery; but it was at this time in sad want of repair. The cause of this was not difficult to discover, the young prince being a ward of the Muskat government, and little care being exercised to guard his interests and protect his revenues and property. At this time, however, the boy was in high favour with the Sultan, and had lately been presented with a small iron gun, of which he was immensely proud. Bait Rudaida is close to the town of Birket el Muz, or "Pool of Plantains," from which it is separated by a low conical hill, capped by a watch tower, placed there to command the water-supply. Around the town is an extensive date grove, intermingled with orchards and cultivation. The population is about 3000, and the settlement is divided into three hujrahs, or sections, one belonging to Sezzid Hamad, and the other two to the El Amair and Beni Riyam tribes respectively.

In the afternoon I walked over the Sezzid's estate with him, and then through the town, which owes its prosperity and extent to the fostering care and liberality of Sezzid Hilal, on whom it had been bestowed when a mere hamlet, as an appanage in addition to Sowaik, by Sezzid Sultan bin Ahmed. The fields produce the usual kinds of corn and vegetables grown in Oman, but were not so regular or well tilled as in most other parts. The product in which Sezzid Hamad seemed to take the keenest interest was sugar-cane, and he did not neglect to show me over his luxuriant plantations. He possessed a rude mill for extracting the juice, and made many inquiries as to the best method of refining sugar. The cane is propagated here, as in India, from cuttings, not from seed, and it is believed to have existed in Oman from time immemorial. Frequent and copious irrigation is necessary for the successful production of sugar-cane, and the Sezzid's fields were watered by a felej or subterranean stream drawn from the hills. The felej is a kind of artificial river, and is one of the most ingenious institutions for bringing water to stimulate the prodigal hand of nature that could possibly be conceived.

The hills abound in fountains, but the soil is so porous and thirsty, and the evaporation from the intense heat so rapid, that irrigation of the valleys and lowlands by any other method would be exceedingly difficult. The ground, though apparently arid and bare, is often fertile enough, and only requires water. Vivify it by irrigation, and it will yield an abundant harvest. The system is wonderfully well adapted to the country and to the economic condition and habits of the Arab. After the initial labour and cost, it requires but little trouble to keep it in repair, and the continual expense and toil of raising water to the surface from wells is avoided. The construction of these underground watercourses is generally undertaken by the tribal communities in each town or village on a sort of joint-stock basis, each individual contributing his quota in money or in personal labour. They are universal throughout Oman, and there are few villages without at least one of these felejes. From a spring at the base of a hill, which may be many miles distant, the villagers conduct the water to their fields through a tunnel or conduit below the surface in the following manner. A line of vertical cylindrical shafts, 4 or 5 feet in diameter and 100 to 150 feet apart, is first sunk between the spring and the village, and these shafts or pits are then connected together by a channel underground in such a way that the body of water, flowing by gravitation, reaches the surface as it approaches the cultivation. The felej is always commenced near the spring, where the shafts are deepest, and the work carried on to the point where the water is required for distribution.

The plan is, of course, more troublesome and expensive than an open irrigation canal, but it has the advantage—one of great importance in this parched and desiccated land—of avoiding loss by absorption and evaporation. In long felejes the upper shafts are often 30 or 40 feet deep, and in some cases the connecting channels are lined with masonry or brickwork. This, however, depends very much on the nature of the soil, a circumstance which also dictates the distance between the shafts. Near the villages the pits are frequently made accessible by steps or a sloped path, to enable the women to procure pure and cool water for domestic purposes. The rows of mounds formed by excavating these pits are a conspicuous and peculiar, though a rather unsightly, feature in an Oman landscape.

The upper apartments of the castle were high and spacious, but very modestly furnished, and not scrupulously clean. The ground floor was devoted to kitchens and storerooms. The place looked dismally bare and empty, comfortless and neglected, and bore the appearance of a house whose glory had departed. It had once been rich in articles of luxury, collected by its founder in the days of his prosperity, but these had all vanished. The work of confiscation and spoliation of Sezzid Hilal's estate was completed by the Metowa under the Azzan-Khalaili *régime* about 1869, but the Birket el Muz property was restored to

the rightful owner, Sezzid Hamad, as an act of justice by Sezzid Turky.

Round the room I occupied ran a broad wooden shelf, on which was ranged a miscellaneous gathering of lamps, clocks, china, medicine-bottles, etc., and among these curiosities was a dusty heap of Arabic manuscripts, of which I made a careful list. They were mostly religious works, and belonged, I found, to a learned Ibadhi Mulla, known as the Kazi, to whom had been entrusted the guardianship and education of Sezzid Hamad. This prince was devoid of political ambition. He never interfered, when he grew up, in the jealous intrigues and factious quarrels so rife among the chieftains of Oman, but led a quiet homely life, absorbed in books and country pleasures, until his retirement to East Africa, where he died in early manhood. His father, Sezzid Hilal bin Mohammed, of whose noble disposition and generous spirit some account was given by Lieut. Wellsted, was a notable personage in his day, and a warm friend of the English. He held a foremost place in general estimation as a member of the ruling family, and was regarded as a man fully worthy to guide the destinies of the nation had he been called to the throne. His memory was long cherished in the country, and seldom, I believe, has a man's death been more sincerely lamented in Oman than when Sezzid Hilal was treacherously murdered by his cousin Kais in 1864. The story of this tragedy was related to me as follows:—

About two years before the close of the reign of H.H. Sezzid Thowaini, who was murdered by his eldest son Salim in 1866, Sezzid Kais of Rostak formed a plot to destroy him and seize the government of Muskat himself. He communicated his plan to Sezzid Hilal, who was too prominent and influential a personage to be ignored, but the latter, having always been loyal to Sezzid Thowaini, indignantly refused to join, and denounced the plot. Sezzid Kais then determined to be revenged, but, failing to find an assassin, had to undertake the task himself. Approaching his cousin Hilal, who, unlike most men of his rank, seldom wore a sword, in an apparently friendly manner, Kais suddenly drew his sword and struck him savagely on the head. Staggered by the unexpected blow, Hilal recovered sufficiently to plunge his dagger into the bowels of his assailant, who fell dead. Hilal was removed to Sowaik, where he expired shortly after. The fort at Sowaik was then assaulted by the adherents of Kais, and, though gallantly defended by Hilal's sister, was captured and annexed to Rostak.

We managed to get the camels ready and make a start at six the next morning, though our courteous young host, Sezzid Hamad, was loth to let us depart, and insisted on accompanying us a good part of the way on horseback before he would take leave. Our road lay over a level plain dotted with acacia and scant herbage, and intersected by

shallow watercourses, the most considerable of which is the Wady Hajar, with a village of the same name. Two hours at a slow trot took us to Zikki, a large and important town on the banks of the Wady Halfain. The wali, or governor, Sheikh Mohammed bin Sinan, who at this time held the castle on behalf of the Sultan, came out to meet us, and received me very cordially. After coffee in a large subla inside the courtyard, the sheikh showed me all over the castle, and then, taking me to an upper apartment, informed me that he wished to give a general entertainment to the Arab escort. I was anxious to push on and cover another stage in the afternoon before halting for the night, but the sheikh was so earnest and persistent in offering hospitality, declaring that it would lower him in the eyes of his people to allow my party to pass his gate unfeasted, that I felt obliged to submit and acquiesce in his wish, though I knew from experience that on such occasions the culinary preparations demand deliberation, and that our day's march was at an end.

The town of Zikki has some beautiful plantations of palms and extensive cultivation, and stands in a very picturesque locality. It is divided by the Wady Halfain, and is supplied by one of the most copious springs of water I have seen in Oman. On the left bank the ground is low, fertile, and well tilled by its occupiers, the Beni Riyam. The right bank is much higher, and on this elevated site are built the castle and the walled quarter of the Beni Rowaiha. Outside the settlement are several watch towers and hamlets of the Âl Amair and other tribes. The population may be 8000, and is mainly composed of the two tribes mentioned, the Beni Riyam being by far the strongest. These tribes, locally known as "Yemen" and "Nizâr," live in a chronic state of antagonism and warfare with each other, ever vigilant against surprise, and ever ready for a skirmish, except in the short intervals of "salfa," or truce. The political relations of both tribes are somewhat confused, as the Yemenite Beni Riyam are now ranked as Ghaffirees, and the Maddic Beni Rowaiha as Hinawis.

The castle is a lofty structure, compact and massive, with walls about 5 feet thick. It was at this time scarcely a century old, having been built on the site of an ancient fort by Mohammed Jabri, maternal uncle of Sezzid Said bin Sultan, but it had an antiquated appearance from its battered and dilapidated condition, one tower having tumbled down bodily. Outside and in front of the castle were two mounted iron guns, old, honeycombed, and unsafe, but capable, as I can affirm, of making a prodigious noise, for they were fired as a salute on our arrival, and this is a quality of immeasurable value in a country where the use of artillery is so little known. The castle not only overawes the whole settlement, but, standing as it does in a commanding position at the head of the Semail valley, dominates and controls one of the chief highways and arteries of traffic. Its possession, therefore, has

always been regarded as a matter of military importance by the central government.

The Wady Halfain is a perennial stream for some distance from its source, and flows to the south-east, reaching the sea at Ghubbet Hashish. About halfway down its course it meets the Wady Kalbuh and Wady Andam, and its grassy bed, which is much frequented by the Bedouins for grazing their flocks, forms the natural road from Mahot to Adam. The elevation of Zikki is about 2000 feet.

The Waly Sheikh Mohammed had duly performed his promise of collecting fresh camels for us, and we were on our way again at daylight next morning. I was about to take leave of him, when he announced his intention of accompanying us part of the way, and from this resolve I could not dissuade him. He rode a handsome and fiery black Arab, and kindly offered me one of his stud, but I preferred a dromedary, as we had a stage of nearly fifty miles before us, and the camel is superior to the horse in speed and comfort on a protracted journey. With our faces towards the north, we found ourselves climbing a gentle acclivity to the crest of the mountain chain, along a rough and stony watercourse, the stupendous crags and precipitous cliffs of Jebel Akhdar rising in dark masses on our left hand, deeply furrowed by ravines and clefts, while to our right the ridge trended away east by north. An hour's ride brought us to the Nejd or summit of the chain, which is 400 feet higher than Zikki. Various names were assigned to this pass by different persons I spoke to, viz. Nejd Beni Rowaiha, Nejd Mujberriya, and Nejd Soharma, but they were all of one accord as to the Nejd being the lowest point of depression along the range. The watershed in this vicinity provides the source of two of the longest rivers in Oman, flowing in opposite directions, viz. the Wady Halfain, already described, and the Wady Beni Rowaiha, or Wady Semail. Crossing the ridge, we descended a stony ravine leading into the main bed of the Wady Beni Rowaiha, and we now saw, stretching out in front of us to the coast, the largest, most populous, and, politically, the most important valley in the land. This long, rich, and splendid valley, lying between two mountain ranges, forms one of the main channels of communication between the coast and the interior, and, though here and there barren, is studded along the banks of its ever-flowing river with a succession of towns and villages, bordered by palms and cornfields, orchards, gardens, and cultivation. Its aspect is much diversified, exhibiting at some places vegetation in great exuberance, while at times we rode over desolate tracts of sand and pebbles without a sign of house or tree. The ranges that form the flanks are somewhat irregular masses of varying height, soaring at some points to lofty peaks several thousand feet in altitude.

At one part the hills approach and contract the valley to a narrow passage, at another they retire to let it expand. Flowing in a generally

north-eastern direction, the Wady Semail is fed by innumerable springs and rivulets, and is swelled after rain by the tributary, but transient streams poured into it by the ravines and torrents. The volume of water that reaches the sea would, of course, be much more considerable were it not for the enormous quantity drained off by the inhabitants to irrigate their fields. The source of the river is in Jebel Akhdar, and the flow is tolerably fast, but without any sudden falls to Semail, from whence the descent is more slow and gradual. Computing the curves and windings, the entire length can hardly be less than 100 miles.

Passing from one fertile strip to another, and wading across the narrow bed of the stream many times in our winding path, we continued to sink more into the heart of the valley, which became more populous, cultivated, and attractive, as we advanced. After five hours' hard travelling we arrived at Wibal, where Sheikh Mohammed left us. He pressed me to stay the night, and I was half inclined to accept the invitation, as I felt rather fatigued, and would have liked the opportunity to see the place, but I decided to move on, and after making the usual presents to the sheikh, I took leave. Wibal stands on the left bank, under a conspicuous white hill surmounted by a watch tower. Behind it to the west rises the imposing Nakhl range, one of the peaks of which, called Jebel Karu Akabet el Kat, with a rugged pass close by leading to Rostak, has been estimated at 7000 feet.

For two hours more we trotted on in the fast-fading light, and it was nigh sunset as we approached the outskirts of the Semail Aliya, or Upper Semail, and began to pass through patches of cultivation and gardens, intermingled with the indistinct forms of houses and date-leaf huts. It was not easy to pick our way among the intricate network of irrigation channels and the labyrinth of palms, and thinking it better not to penetrate further, lest we should disturb and alarm the people by the sudden appearance of a mounted party in their midst at nightfall, we turned off to camp by the stream.

The Beni Rowaiha are the remnant of a renowned and noble tribe, the Beni Abs. Of the race of Adnan and the stock of Ghatafan, they claim descent from the Beni Hâshim, and on their first arrival in Oman called themselves the Beni Hâsham. The patronymic of the tribe seems to be Rawaha bin Rabia; they are, however, often still spoken of by other Arabs as the Wilad Abs. Though one of the most recent immigrants, having probably entered Oman after Mohammed, the Beni Rowaiha have gained possession of one of the best-watered valleys in the country, and now hold an influential position, being a powerful community of about eighteen thousand souls, peopling thirty villages. Surviving to some extent to this day—for the breach has never been completely healed—the feud between the Abs and Dhobyan had its origin in a quarrel about a horse-race in Nejd, in the sixth century of our era, and the war that then took place is known to fame as the

"War of Dâhis," the two tribes being at this time enemies and neighbours in Oman, as they were in Nejd 1400 years ago. The story of the War of Dâhis, which lasted for forty years, is a typical illustration of the internecine strife that occurs at intervals in Arab nomadic life, even at the present day. The details of it, as collected from many Arab poets and narrated by Fresnel and Caussin de Perceval, are very curious, but are too long for insertion here, and I can only give a bold outline.

In the year 562 A.D., the Sheikh of the Abs, Kais ibn Zohair, made a successful foray on the Thalaba tribe, and as a ransom for the booty and captives taken, demanded and received a famous horse named Dâhis. The extraordinary fleetness of Dâhis became the theme and boast of the tribe, and the envy of their neighbours, and it was not long before a match was made to race him with another horse. This was done by a cousin of Kais, who agreed with Sheikh Hamad bin Bedr of the Dhobyan tribe, to run Dâhis against a Fezara mare named Ghuba for a wager of ten camels over a course of fifty bow-shots. The match had been made entirely unknown to Kais, who, when informed, highly disapproved of it, and wished to withdraw, but eventually the wager was increased to a hundred camels, and the length of the course to a hundred bowshots. As the day fixed for the race approached, the horses were kept without water, the plan being that the horse which first plunged its nose into the water-trough 10 miles from the starting-point should be declared the winner. The racers were to run riderless, and to make them gallop their best, maddening thirst was to take the place of whip and spur. Over the yielding sandy plain the superior strength of Dâhis told, and he was soon well ahead of his rival the mare, which, though fleet, had less staying power. He would undoubtedly have won the race had it not been for a ruse of the Dhobyan Sheikh, who had concealed a man in a hollow in the course, with orders to check Dâhis and throw him off his stride. The trick succeeded, and Ghubra was first at the goal. Kais was informed of the stratagem by onlookers, and was beside himself with rage and vexation. As the race, however, had taken place in the country of the Dhobyan, he was powerless to do more than protest, and after vainly endeavouring to induce Sheikh Hamad to repair the injustice by restoring the wager, he returned home. The Abs were so hot and eager for revenge that the first blow was soon struck, and the first victim was a brother of Sheikh Hamad, who had acted so perfidiously. On this event hostilities would have ensued, of course, if the Abs had not immediately paid the Dhobyan the bloodwit of one hundred camels. Sheikh Hamad accepted this payment for his brother's death, but, after doing so, avenged himself by treacherously slaying a brother of Sheikh Kais.

In the war that now followed, the first battle, known as Dhul Marâkib, was a triumph for the Abs, but in the second the Abs were disastrously beaten, and obliged to give hostages. A long truce was

then concluded, at the termination of which, in the year 576 A.D., Sheikh Hamad, instead of restoring the hostages given by the Abs, foully murdered them.

The attack made by Sheikh Kais, directly he heard the news, was so sudden and furious that the Dhobyan were taken by surprise, and suffered a loss of twelve killed. After this the position of the Abs became so critical, for they were much inferior in strength to the Dhobyan, that they resolved to migrate. They were pursued by the Dhobyan, who were plundering the baggage, when the Abs, making a sudden onslaught, routed them with great slaughter, killing Sheikh Hamad bin Bedr, whose treachery had caused the war. After many wanderings and adventures, the Abs arrived at last in the territory of their old enemies, the Amir bin Saasaa, by whom they were kindly and hospitably received.

The Amir were at this time at feud with the Beni Temim, who had meanwhile allied themselves with the Dhobyan, and as war was now inevitable, the two coalitions collected their strength for the final struggle, the force put into the field by the Dhobyan and Temim tribes being, it is said, the largest ever assembled in Arabia. The Abs and Amir tribes retired to a precipitous defile called Shoab Jabala, where they awaited attack. The enemy, confident in numbers, attempted to storm the ravine, but were thrown into confusion by a device, and the Abs, rushing down, utterly routed and dispersed them. This famous fight took place in 579 A.D., and practically terminated the campaign, though the tribes continued a desultory war for about thirty years longer, when they were finally reconciled by mediation, and the Abs returned to their former abode. Sheikh Kais ibn Zohair, however, scorned to make peace with his enemies, the Dhobyan, and retired to Oman, where he turned Christian, and became a monk or recluse.

Such is the brief story as preserved in ancient poetry, but the oral tradition of the tribes has somewhat varied it in course of ages; for instance, many Arabs believe now that Dâhis was ridden by Sheikh Kais, and the mare Ghubra by Sheikh Hamad.

Early the next morning, July 17, I crossed the boundary and entered Semail Sifâla, or Lower Semail, where I was met and greeted by the Wali Sezzid Nasir, whose acquaintance I had made two years before at Soor. After coffee I informed him of my intention to proceed on to Muskat at once, and asked him to procure fresh camels without delay. To this he demurred, begging me to stay with him till the following day, and saying it was his duty to entertain my Arab following in proper style before he could let them depart. I did not relish the delay, but it was impossible to refuse the Sezzid's hospitable courtesy, and I therefore consented to the feast on condition that the camels were forthcoming by 1 p.m. Sezzid Nasir then led me to a summer abode in a small garden at the edge of the stream, where I was furnished with

the customary carpets and cushions, and where he left me to enjoy the luxury of a bath before breakfast.

The "Dayara," or circle of Semail, may be called the capital of the valley, as it contains the residence of the wali, a strong castle, and is the chief centre of population in it, being occupied by various tribes. It is, however, not a single compact town, but rather an aggregation of twelve adjoining, unwalled villages, with their plantations, fields, watch towers, and homesteads, forming, as a whole, a picturesque and luxuriant settlement, extending along the valley for 10 miles, with an average breadth of 1 mile. The names of the different villages composing the Dayara are—Semail Al Hajir, Ghobra, Harras, Zok, Mizra, Sital, Jemmar, Bistan, Sifeh, Jebeliya, Dubk, and Sil el Saheileh. These are divided into two nearly equal parts, known as Upper and Lower Semail, the former being held by the Beni Rowaiha and other Hinawi tribes, and the latter by the Ghaffiris. The castle stands in Upper Semail. The boundary-line separating these two hostile camps is sharply defined by a small transverse ditch called Sherkat el Haida, and across this ditch many a fight has taken place, for the tribes are constantly quarrelling and skirmishing. In these little affairs the combatants usually commence operations by firing at each other across the Sherkat from behind cover, and then, heated with the fray and stung to fury by the taunts of their adversaries, engage at close quarters, using their long double-edged Omani swords with great effect. Sometimes, when the river is very low, the Himawis above try to dam up the stream, and thus cut off the supply of water from their enemies, the Ghaffiris, and this plan, when successful, which, however, is rarely the case, quickly brings about a suspension of hostilities and a truce.

There is a daily bazaar or market held close under the north side of the fort, and consisting of the usual food-supplies required, fruit, vegetables, meat, and salt fish, but no cloth or hardware shops. Semail, indeed, can boast of but little trade. Authority is too weak, and the general feeling of insecurity too prevalent, to allow of much traffic being carried on.

The settlement is rich in "Fard" dates, one of the finest varieties of this fruit produced anywhere. It is the kind most appreciated and esteemed by the Americans, who are good judges, and a very large quantity of boxed Fard dates is annually shipped to the New York and Boston markets. At the period of which I am writing (1876), Muskat was regularly visited by sailing ships from Boston for cargoes of pressed dates in bags, but of late years a change has taken place, and the Fard dates are now packed in boxes, and exported to the United States by steamer. Fruits grow here in great abundance and variety, and of excellent quality. Muskat and other markets are largely supplied from Semail.

The only manufacture in the place worth mention is cloth-weaving,

and the creaking of the loom may be heard in every hamlet. Lungies, puggries, and khodrungs are the chief articles produced, the cotton of which they are made, both white and brown varieties, being extensively grown in the valley. The loom is somewhat heavy and clumsy in construction, and is horizontal (not vertical like the Jewish looms we read of in Scripture), and the weaver sits and works at it in a shallow pit, with half his body below the surface.

The annual revenue derived by the Sultan of Muskat from Semail for local expenditure is said to be 6000 dollars; two-thirds of this amount being yielded by the zakât, or tax, and the remaining one-third representing the produce of the Bait al Mâl, or crown lands, which are usually farmed out.

The population of Semail is probably from 20,000 to 25,000 souls, but in such a large and scattered place is difficult to estimate.

The eastern range has fewer peaks, and presents a more broken contour, than the western. It is known by many different appellations as we pass along it, its highest peak (5250 feet) being called Jebel Tyin. Just above the village of El Zok the road to Ak branches off, and it takes three hours of very rough travelling to reach the village of that name. The Wady Ak is regarded as the key of Muskat from the direction of the Sharkiyah, or eastern province, as it offers the most direct route to the capital. When on the war-path to attack Muskat, the Sharkiyah tribes, if permitted, pour down this steep and rugged defile into the wild entanglement of hills and ravines beneath, and thence into the Wady Semail; but the Nedâbiyin tribe, to whom the Akabet el Ak belongs, is usually subsidized by the Sultan to hold the pass. The valley is here very much shut in, but I obtained a fine view of the gigantic mass of Jebel Akhdar from the village of Ghobra.

On an isolated rocky eminence rising sheer above the floor of the valley, to which it presents on the western side a precipitous cliff, 300 feet in height, stands the ancient castle, whose imposing aspect adds much to the local scenery. The position is a commanding one, and well suited to enable the castle to serve the threefold purpose for which it was no doubt intended, viz. to overawe the turbulent part of the community, to command the passage of the valley, and to protect the whole settlement.

The hill has been scarped at the base on all sides, and the plan of the castle has been entirely influenced by the nature of the ground. The massive barbican, or gateway, in which are apartments forming the residence of the akeed, or captain of the garrison, is on the eastern and lowest side, and is joined to the keep at the south-western corner by low curtain walls, embracing an area of irregular shape and considerable extent. The keep is a large circular tower of solid stone masonry, built on the highest point of the rock, affording a superb view over the valley. In the barbican are two wells cut through the

rock, giving an unfailing supply of water, and in the keep is a capacious reservoir, always kept filled. I counted eight iron guns in the fort altogether, three mounted on field carriages, the others dismounted. The castle was in a battered and shattered condition at this time, having sustained a bombardment during the recent operations undertaken by the Sultan to recover possession of it from a rebellious relative, but the wali informed me he had received orders from Muskat to repair the breaches in the walls. The wali is the castellan as well as the governor of the district, but does not reside in the castle, the guardianship of which is entrusted to the akeed, who at this time was a Belooch with sixty men under him. Sezzid Nasir told me he took care to interfere as little as possible with the tribesmen, and confined himself to maintaining peace and order and settling disputes. I gathered that the position he held was one demanding much tact, patience, and discretion, and was not a very enviable one, but he was evidently treated with great deference and respect by all.

Our host's hospitalities occupied all the forenoon, and I found my party extremely reluctant to make a move; but, though the day's march before us was no shorter than that of the previous day, I resolved to push on, and having taken leave of my courteous friend Sezzid Nasir, I mounted my camel and started.

From Semail castle the road winds down the valley in a north-north-easterly direction for 12 miles, as far as Serur, from whence it runs nearly due north. Serur is a rich and pleasant oasis of some extent in the possession of the Beni Hina tribe. At this point the stream disappears from sight, and sinks in the porous soil to flow underground for some distance, when it again reappears. A mile beyond Serur is the hamlet of Malita, and at another mile we came to Bidbid, a charming little oasis with a multitude of dates, rising like a green islet out of the broad barren sandy bed. In the centre is an old fortlet, untenanted, and fast crumbling to dust. Below Serur the hills begin to retreat from the river-bed, especially on the western or left bank, and the valley now gradually merges into a broad and open plain.

At Mizra, a village with an isolated rock and watch tower, the road to Muskat branches off to the right; but I may as well continue, from notes made on a subsequent trip, the description of the valley down to Sib, before going on with the narrative of the present journey. After leaving Bidbid, the path runs along the left bank over stony ground for about 5 miles, and then leads into a populous and thriving oasis called Fanja, the wady at this part being known as Batha Fanja. This town belongs to the Beni Hina and Hedâdebeh tribes, and is surrounded by a luxuriant belt of palms and well-cultivated fields, extending perhaps 3 miles in length. It lies 20 miles from Semail, and the population exceeds three thousand. The town owes its prosperity to the existence of excellent potter's clay in the neighbourhood, suitable for

cooking utensils and glazed earthenware. The large jars used by the indigo-dyers and similar vessels are also produced at these potteries. Just beyond Fanja a masonry aqueduct, 3 miles in length, called the Felej el Dhowaikar, runs at some height along the elevated right bank, and leads to a village and fortlet of that name, now in ruins. It was constructed, I was told, in the middle of the eighteenth century, by the Imam Sezzid Ahmed bin Said, to whom Dhowaikar belonged, and appeared to be an unusually costly piece of engineering for Arabs to undertake, but when, long years ago, Dhowaikar was destroyed and deserted, the aqueduct fell into desuetude and decay, and has since been breached in many places by mountain torrents. At three hours from Fanja, and about 35 miles from Semail, we arrived at the castle of Khoth, which is picturesquely perched on a solitary hill, rising out of the river-bed, with a hamlet and patch of fruit orchards below. It belongs to the Hedâdebeh tribe, and is considered a position of some importance, as the castle overlooks, and to some extent commands the lines of communication between Muskat and the Batina. On the left or western bank, the Wady Sakhnan, known in its upper course as the Wady Beni Jabir, unites here with the Wady Semail. It can be reached in the vicinity of Semail by a low pass, and affords, thence, an alternative and short road to the Batina plain. The country between Khoth and the sea, a distance of about 12 miles, is bare, uninhabited and uninteresting.

Resuming our journey from Mizra,* we took an easterly direction, and skirted on our right the hill range, which here trends along the coast, the path leading over a tract of broken and stony ground, very irksome to the camels, and necessitating a slower pace. Passing a low ridge known as the Nejd el Shubba, we rode for about 16 miles over a narrow maritime plain, much furrowed and intersected by ravines, and having several hamlets belonging to petty tribes, to Wataya, the site of a palace built by Sezzid Thowaini, now in ruins. It was now getting late, but in another hour or so, passing Rui and Bait el Felej, we arrived at Mutrah.

THE CRUX OF THE UPPER YANGTSE.

By ARCHIBALD LITTLE.

A DESIRE to see the upper Yangtse in flood-time induced us to venture upon a voyage from Ichang to Kweifu and on to Wan Hien, traversing the four great gorges and the principal rapids at a season when few care to brave the perils of navigation. The up-river trade from Ichang to Chung-king practically comes to a stop by the middle of June, and

* This is not the Mizra at Semail.

S.S. *PIONEER* GOING UP THE YEHTAN, THE WORST RAPID, ON HER FIRST VOYAGE.

is not resumed before the middle of September or later, according to the condition of the river and the amount of rainfall in West China. Those who, in the usual course of travel, have ascended the upper Yangtse only in the winter season, when the junk-traffic is at its highest, would not recognize the river in summer, when the freshets have come down and entirely changed its aspect, from that of a clear mountain stream, interrupted by a series of falls or steps with long smooth reaches between, to that of a huge brown torrent entirely filling its bed and bounded throughout either by vertical cliffs or by steep mountain slopes—rocks all "submerged full fathoms five," and deep water everywhere. The innumerable winter rapids are either obliterated entirely or metamorphosed into swift races; a rare junk is seen here and there sailing up in the eddies and long backwaters, or creeping slowly, towed by a double gang of trackers, round some awkward point; but generally the river appears deserted, the exuberant life and animation that surrounds the rapids in winter has entirely vanished, and the sleepiness of summer heat appears to have invaded the sparse towns and villages, while in between, for days at a time, one might imagine one's self to be exploring a new and uninhabited country. The cause of this cessation of traffic in the summer season is not so much the danger (that from the huge whirlpools is really serious), and which, to do Chinese boatmen justice, would hardly prove a deterrent, but the expense of the voyage is doubled; heavier crews are needed, and these have to be paid and fed for two, and sometimes three,

months instead of one; correspondingly high freights have to be paid, and this again deters shippers; the north-east monsoon, which may be relied upon to provide a fair wind up the gorges from November to April, has come to an end, and without a fair wind parts of the gorges are actually impassable by large junks relying on man-power alone, as they may in summer have to wait days for a fair wind. To sum up, in short, when the upper Yangtse is navigable by steamers it is unnavigable by native craft, and *vice versâ;* to the observance of this condition are due the successful voyages of the steamship *Pioneer* (now metamorphosed into His Majesty's gun-vessel *Kinsha*) in the summer of 1900; and, conversely, to its neglect may be attributed the loss of the German steamer *Suihsiang* in the month of December in the same year.

Our voyage up the rapids, starting on June 14, 1901, occupied roughly as many days as, at the same date last year, the *Pioneer* occupied hours; thus to reach the big rapid, the "Yeh-tan," about 60 miles above Ichang, took us six days, as against the *Pioneer's* eight hours on June 12, 1900. We, on our third day out, passed the Tungling rapid, 35 miles distant from Ichang, on the rocks in which the *Sui-hsiang* was wrecked on the very morning of her departure from Ichang. This "pierced mountain" rapid is caused by the outflow from the Grand Mitan gorge passing through a nest of rocks, amidst which in winter the river forces its way in numerous winding channels. In June these rocks are deeply submerged, and only traceable by the boiling water as the 7-knot current sweeps over them. The long time spent by us in reaching this point was due to the difficulties of the

THE TUNG-LING RAPID AT ENTRANCE TO MITAN GORGE AT HIGH WATER.

"Yao-tsa-ho" below, as the winding reach, some 15 miles in length, which connects the Ichang and Mitan gorges, is called by the boatmen. The river valley here widens out, and, whereas in the two gorges the stream has cut its way down through the limestone mountain, making itself a passage with vertical walls 1000 to 2000 feet in height, in this connecting reach the river has to contend with a granitic formation, which it has disintegrated and broken up into piles of gigantic boulders, which lie strewn along the floor of the here widened valley in vast mounds such as none but Yangtse trackers, trained to them from childhood, would attempt to climb over. The "points" thus

THE TUNG-LING RAPID AT LOW WATER.

formed convert the Yao-tsa-ho into a continuous rapid, which the junk has to surmount without ever being able to gain a straight lead for its tow-lines; hence a perpetual struggle, which the imperturbable Chinaman calmly accepts as all in the day's work, but which is most exasperating to the impatient foreigner. To the geologist this reach is peculiarly interesting as the one point in the navigable Yangtse at which igneous rocks lie athwart the river's course, and where a dyke of porphyry has been cut through by the stream. Immediately above the Mitan gorge the valley, though still bounded by precipitous mountains rising to 3000 and 4000 feet, opens out, leaving a bench on either hand upon which are built the busy village of Hsin-tan ("New rapid") and

the picturesque houses of prosperous farmers and junkowners, forming a *coup d'œil*, that can hardly be excelled in any part of the world. Writing of the Hsin-tan as it appears in January, Mrs. Bishop remarks, "No description can convey an idea of the noise and turmoil of the Hsin-tan. I realized it best by my hearing being affected for some days afterwards. The tremendous crash and roar of the cataract, above which the yells and shouts of hundreds of straining trackers are heard, mingled with the ceaseless beating of drums and gongs, some as signals, others to frighten evil spirits, make up a pandemonium which can never be forgotten." If this indefatigable traveller could have seen the Hsin-tan when we passed up—all its rocks and boulders hidden, the shanties with which these are covered in winter all disappeared, the trackers having gone into the country for fieldwork; nothing but a smooth river, half a mile or more wide, with scarce a junk visible; the fine farmhouses and residences that dot the steep slopes on the south bank slumbering amidst their groves of bamboo and fruit trees; the long straggling terraced village on the north bank equally asleep in the June sunshine, with not even a dog awake to bark, she would have hardly credited the change, such is the contrast between the upper Yangtse in summer, when it has already risen 50 or 60 feet above its winter level, and may yet rise another 60 feet before autumn.*

Our light-draft junk warped up the short, smooth, steep slope of the Yeh-tan, a fall of about 8 feet, without difficulty. The two tow-lines are carried by a straight lead to and warped round bollards fixed in a wide solid stone bunding built for the purpose well above high-water mark, the whole operation, including the laying out the lines, involving us in scarcely two hours' delay. I may mention that our junk is one of the large "four-roomed" kwatsze, as the upper Yangtse houseboats are called, 80 feet long by 12 feet beam, 4 feet deep, and drawing light about 2 feet, easy to tow, and a fast sailer with her lofty mast and large light cotton lugsail. We have forty-seven men engaged in all—permanent crew of ten always on board, twenty-four trackers on shore, eight men in the tender constantly shifting the trackers from our junk to the shore, and from one bank to the other, or ferrying them across side streams and past otherwise impassable obstructions, and finally a crew of five men in the lifeboat, which follows close as a precaution in case of disaster. Above the Yeh-tan our progress was slow; the river was very bad, and the whirlpools at times baffling, notably that at the Niu-ko or Ox-head rapid, at the point where H.M.S. *Woodlark* was whirled against the rock bank and had her fore compartment entirely

* Fifty feet rise at the Shin-tan means a rise of 25 feet above low-water level at Ichang, where alone accurate measurements are taken by the officers of the I.M. customs, the water being dammed up above the narrows of the Mitan gorge.

THE WITCH'S GORGE, OR WUSHAN HSIA.

smashed in; this last was later rebuilt on the spot by her able commander and gallant crew—her engineer especially—and thus against all expectation she was enabled to pursue her voyage to Chungking. The record of this noteworthy event, which her crew painted in huge letters on the rock at the time, was submerged as we passed up. Then through the 22-miles-long "Great Gorge of Wushan," which it took us three whole days of hard struggle to surmount, into the *comparatively* open water that unites this chasm with the still worse chasm of the last of the four great gorges, the "Bellows" gorge, situated three miles below the celebrated city of Kueifu, and on the left-hand portal of which stands what is left of the "White Emperor's City."

Before reaching the lower entrance of the Bellows gorge, and opposite the Hoang-tsang-pei, a swirling rapid caused by one of the innumerable huge "cones of dejection," which small innocent-looking side streams appear to have vomited into the main river as the result of a one-time cloud-burst in the mountains behind, a very remarkable cleft in the 3000 feet which here forms the river's right bank, compels the admiration of the traveller. This cleft, the opposing cliffs of which may be half a mile apart, is well named by the natives the "Tso-kia Hsia," or "False Gorge," the legend being that when the Emperor Yü cut out the gorges through the mountains, that isolate Szechuan from the rest of China, and so drained off the great red basin, he at first set to work on

the Tso-kai Hsia, when, finding no way round, he diverted his attack to the higher mountains through which the Bellows gorge now makes its way, and cut out the present passage in its place. Through this narrow passage was now running a fierce torrent, the overflow of the lake-like expanse above. So far we had only experienced a recurrence of the minor accidents incidental to junk travel, tow-lines breaking, sheering out (ta chang) in the rapids (equivalent to missing stays at sea), and the like, but here our voyage came near to an abrupt conclusion. A strong fair wind that set in towards evening induced our pilot to attempt to sail through this 6-mile long gorge; under press of sail we were stemming the current famously, but the still fast-rising river had bred such terrific whirlpools that our large well-found junk proved like a cork at their mercy. We swung round and all but capsized; luckily the men, with much difficulty, succeeded in lowering the sail and bringing the boat up under a protecting point without damage. No such good fortune, however, attended two large cargo junks ahead of us, which we overtook at the entrance of the gorge; one of these, a vessel chartered by the Sechuan viceroy carrying munitions of war from Shanghai to Chêngtu (of which a continuous stream, including machine guns, has been flowing west for two years past) was whirled against the rock bank on the right and stove in and sunk, her crew escaping and the roof of the junk being just awash, so that the contents may possibly be salved when the water falls. The second junk, a fifty-ton cargo-boat

SHIUTAN.

laden with cotton yarn, sailed up the swift rapid in splendid form and disappeared in the twilight. I asked our pilot, who had now secured our boat for the night, why he too did not take advantage of the fair wind, which was still increasing in strength, to get through this difficult gorge. He replied that he could not feel sure of getting through before dark. At this moment a shout from our men, and just as the sudden darkness of the latitude had shut in, the big junk drifted by on her beam ends, having capsized in mid-stream. She was barely visible, but the cries of "Chiu Ming!" ("Save life!") were heartrending, just audible above the roar of the rapid. It was now pitch dark, but I

TURN IN MITAN GORGE.

suggested to our accompanying lifeboat to go after them; the helmsman, however—and rightly, I think—said he dared not confront the whirlpools in the dark. Two days later we learnt in Kweifu that about half the crew had been thrown overboard and lost, and that the boat herself, if still floating and not wrecked on the way, could hardly be brought up nearer than in the tranquil water off Ichang.

The Bellows gorge averages 300 yards in width, but is narrowed by projecting rock-spits in three places to half this width, and below these rage, at this season, foaming whirlpools. The spit under which we were moored for the night was composed of a very hard limestone and chert, and had the appearance of furnace slag. Rising some 30

to 50 feet above the present water-level, it is covered in the late summer freshets, and so the whole surface is water-worn; but the rock is too hard to be cut away in potholes, as we see has been, and still is being, done in countless similar reefs up and down the river. At the narrowest channel in this gorge, close to its upper end, the stanchions and rock-holes are still visible at low water from which chains were stretched across the Yangtse during the romantic period of the wars of the "Three Kingdoms," which ushered in the fall of the great Han dynasty in the third century of our era. All this region is rich in "song and story." Below this spot we see to-day, as fresh as it issued from the hands of the masons of old, the extraordinary relic known as Mêng-liang's ladder—a series of squared holes chiselled into the hard limestone cliff, here about 500 feet vertical, each hole 14 inches in diameter and about 2 feet in depth, into which were inserted wooden beams up which Mêng-liang's soldiers either ascended for attack or descended to procure water—it is not positively known which. The last emperor of the Hans, Liu-peh, was the builder of the "Peh-ti-ch'eng," or "White Emperor's City," so called after its supposed Celestial founder and patron, a beautiful temple in whose honour survives to this day. Its wooded terraces command a striking view of the gorge down stream, with its highest cliff towering up some 3000 feet, and of the picturesque city of Kweifu built on the left bank of the lakelike reach 3 miles above.

We passed a restless night, rocked in the swell of the rapid and disturbed by the roar of the whirlpools, which increased in violence as the river continued to swell in volume with the still-rising freshets, the total rise in the night being about 10 feet, necessitating constant shifting of the boat's moorings. At daylight the next morning we crossed over in the lifeboat to the left bank, and climbed up the steep rock-bank to the New road. This is a road built by a former viceroy in the fifteenth year of Kwangshü (A.D. 1888), from Kweifu westwards to the Hupeh frontier, a distance of about 50 miles, where, traversing the gorges, the road is carried by a gallery cut in the limestone cliffs and fenced by a low stone balustrade. Had the road been carried on farther 80 miles to Ichang, it would have been of inestimable value to travellers to and from Szechuan, who have practically no choice of any other than the Yangtse route. As it is, the road is useless; it ends in an absolute *cul-de-sac* in the middle of the Wushan gorge, and is already falling into disrepair. Squatters have not been slow to take advantage of the terraced portion to grow crops on, and have pulled down the stone balustrade in places and used it as foundations for their adobe cottages. So it is everywhere in China: a spasmodic attempt at some reform or improvement is made by some rare, public-spirited official or man of wealth; he is not seconded, and his work is rendered useless by the apathy and ill-will of the people generally. It seems to

me hopeless to look for any practical reforms in China unless under European supervision, capable of enforcing discipline and order as in the foreign settlements; left alone, the Chinese are incapable of what we call progress. If this road were to be completed and sufficiently enlarged, Kweifu would be brought within three-quarters of a day of Ichang, and thousands of lives, now annually lost in the rapids of the four great gorges, would be saved. But there is no present likelihood that this road ever will be completed. In a few more decades, what has been already begun will have fallen or been pulled to pieces and utterly forgotten.

The White Emperor's City, the western terminus of the New road, is now nothing but a small village. A portion of the old concrete wall is still in existence, pierced by an ancient gateway, through which the path leads on to the high-walled city of Kweifu, 3 miles above. It was here that Liu-peh made his last stand, and was killed A.D. 221, and so the famous Han dynasty succumbed to the short-lived Wei. It is hard, looking down at this season on the smooth lake 200 feet below, to conceive the existence of a manufacturing city in its centre, which is annually submerged each summer and again annually reconstructed each winter as the water subsides. Yet on this sandbank, now submerged several fathoms, I have seen the smoke of countless brine distilleries, and have walked among the brine wells, around which thousands of workmen were busily employed on the different processes, hastening to make the most of the short winter of work. In Kweifu coal is cheap (about 4*s.* a ton), as also plentiful.

Arrived at Kweifu, the perils of the voyage are practically over—at least, at this season. Hence to Wan Hien we had not the trace of a rapid; the bottle neck of the Bellows gorge had dammed up the water, and the fierce Miao-chi and the dreaded Hsin-lung-tan were absolutely non-existent. The river, now fully 100 feet above its winter level, and half to three-quarters of a mile wide, flowed smoothly between green slopes, not a vestige of rock being visible. The contrast between the deep bright green of the maize, which now covers the lower slopes, and the chocolate-coloured water, in which their feet were immersed, was very striking, as was the total absence of life and movement at the site of the New Grand Rapid, formed by the landslip of 1896. No trace of the town existed, the houses mostly removed, the site being under water; but on high ground above is a handsome and extensive building—a new Buddhist temple dedicated to Wang Se, the patron saint of boatmen, and subscribed for by the junkmen, to whom this rapid is a lasting terror in the winter season, for want of a few tons of dynamite judiciously expended.

One thing our summer voyage on the upper Yangtse definitely impressed upon us, and that is that a permanent and profitable steam-service is simply a question of supplying the needful capital for

suitable boats. Is this navigation to be carried on or to be abandoned to others by the British, who have been the first to successfully attempt it? In any case, we reached Wan Hien, fourteen days out from Ichang, with the firm conviction that this would prove our last ascent of the upper Yangtse in a Chinese junk.

GEOGRAPHY AT THE BRITISH ASSOCIATION, GLASGOW, 1901.

THE excellent arrangements at Glasgow for the 1901 meeting of the British Association contributed in no small degree to make the meeting the decided success which it is generally acknowledged to have been. Rarely has the Association been so fortunate in the quarters assigned to it as during the present year, when the use, generously permitted by the governing body, of the spacious buildings of the University of Glasgow, enabled the whole business of the meeting to be carried on within a compact area, and obviated the wide dispersal of the sections which has so often been found unavoidable in previous years. Although, taken as a whole, the attendances at the geographical section cannot be said to have been large, there is reason to look with satisfaction at the general results of the meeting from a geographical point of view. Dr. Mill's able presidential address, which was printed in the last number of the *Journal*, laid down, more clearly perhaps than had yet been done in this country, the true position and aims of geographical science, and should do something to bring about an improved understanding of that position on the part of educational authorities and the public generally, though it is probably too much to hope that it will once for all set at rest the objections of those who refuse to concede to the subject the rank of a science at all. The papers read maintained, on the whole, a fairly high scientific standard, and though this may possibly have acted as a deterrent to certain among the frequenters of the section, it can only be regarded with satisfaction by those who desire an improvement in the position held by geography in this country.

The officers of the section were as follows:—

President: Dr. H. R. Mill, F.R.S.E. *Vice-Presidents:* Sir T. H. Holdich, K.C.I.E.; J. Scott Keltie, LL.D.; H. J. Mackinder, M.A.; E. G. Ravenstein; Sir George S. Robertson, K.C.S.I.; Rev. Prof. George Adam Smith, D.D. *Secretaries:* H. N. Dickson, B.SC., F.R.S.E. (*Recorder*); Edward Heawood, M.A.; G. Sandeman; A. Crosby Turner. *Committee:* Col. F. Bailey, late R.E.; W. S. Bruce; A. Buchan, F.R.S.; Dr. J. Burgess, C.I.E.; G. G. Chisholm; Vaughan Cornish, D.SC.; Captain H. P. Deasy; Dr. Henry Dyer; H. O. Forbes, LL.D.; Prof. P. Geddes; A. J. Herbertson, PH.D.; Col. D. A. Johnston, R.E.; Captain Lemaire; Prof. J. Milne,

F.R.S.; Dr. F. Moreno; H. Yule Oldham; Staff-Commander Dubois-Phillips; Prof. A. F. Renard; T. G. Rooper; A. L. Rotch; Prof. G. F. Scott-Elliot; Eli Sowerbutts.

As usual, the section met on four days, and, in addition to the President's address, twenty-seven papers and reports were read, several being followed by important discussions. The following is a summary of the proceedings on the several days:—

Thursday, September 12.—Mr. Ravenstein gave an account of the old geographer, Martin Behaim of Nürnburg, best known as the constructor of the celebrated globe of 1492. It was shown to be exceedingly doubtful whether, as is stated by Barros, Behaim was a pupil of Regiomontanus, though it is possible that he did accompany the astronomer José Visinho on his voyage in 1484 to the Guinea coast, for the purpose of determining latitudes by the aid of the astrolabe. Behaim claimed to have accompanied Cão on his second expedition (1485–86), but Mr. Ravenstein showed that this claim cannot be allowed, though quite possibly Behaim took part in the expedition, also of 1485–86, of João Affonso d'Aveiro, which reached the Benin coast. Photographs and drawings of the famous globe were exhibited at the meeting, and it was announced that a full description and facsimile would shortly be published.

Mr. Ravenstein next presented the annual report of the Committee on the Climate of Tropical Africa, which, he said, had now completed ten years' work, and would not seek re-appointment, arrangements being under consideration for the publication of the results of observations in future under Government auspices. The final report gives returns from twenty-one stations in Africa, distributed between Egypt and the Sudan (2), Nigeria (1), Nyasaland (4), and British East Africa (14, including the four lake-stations in Uganda). It also includes the results of seven years' observation on the rainfall at Mengo (Uganda), taken from the unpublished journal of the late Mr. A. M. Mackay, as well as a table giving the rainfall since 1890 at a number of stations.

The ten years' work of the Committee has resulted in the publication of meteorological observations from seventy-one African stations; but of these only fifty-six show records for a complete year, and eleven only give a full five-years series. These latter are Lauderdale, Dunraven (rainfall only), Kisimayu, Malindi, Lamu, Takaungu (rainfall only), Mombasa, Chuyu (or Shimoni), Machako's, Fort Smith (Kikuyu), and Mengo (Namirembo and Natete). Especially careful and full observations have, however, been taken for shorter periods at Bolobo on the Congo, Kibwezi in British East Africa, Old Calabar, and at Zomba and Fort Johnston in Nyasaland, where most valuable work is being done under the direction of Mr. McClounie, the head of the Scientific Department. In the Egyptian Sudan stations are being gradually pushed forward by Major Lyons. The report also gives the

result of observations on the lake-level of the Victoria Nyanza, which were the subject of an article in the *Journal* for October.

Mr. Ravenstein briefly summarized the general lessons to be learnt from the results gained so far in relation to the possibility of European settlement in tropical Africa. No single district, he said, could really be regarded as possessed of a thoroughly healthy climate, for even where, owing to the elevation, the mean temperature is moderate, the fact that the days are hot and the nights cold renders the climate trying, while the humidity of the atmosphere at many of the stations is also a drawback.

Dr. A. J. Herbertson exhibited a morphological map of Europe, and described the various natural regions into which the continent may be divided, pointing out the connection which exists between the geographical structure and surface features. The paper was an excellent specimen of modern methods applied to geographical research.

In the afternoon Mr. G. G. Chisholm gave in outline his thoughtful paper on "Geographical Conditions affecting British Trade," which was printed in full in the last number of the *Journal*. An interesting discussion followed, in which, among others, Mr. Atkinson, well known as an American writer on economic questions, took part, pointing out certain conditions which were likely in the future to tell especially in favour of American trade, particularly if, as the speaker anticipated, a policy of free trade were inaugurated in the United States. Prof. Alleyne Ireland then spoke on the influence of geographical environment on political evolution. The subject, he said, was of great practical importance by reason of the attention now directed to the tropics and sub-tropics as a field for commercial activity, and the necessity, in the interests of trade, of the introduction of stable government in those regions. With very few exceptions, the natives of the tropics have hitherto shown themselves incapable of developing a government possessing any real element of stability, and this the speaker attributed to the lack of the climatic discipline to which the inhabitants of more temperate zones have been subject. He therefore held that the climatic conditions of the tropics have set an insuperable barrier to the advancement of tropical peoples in the direction of popular government, and that in this zone administrative affairs must rest in the hands of specially trained Europeans. Time did not admit of a discussion on the paper, which, from its controversial nature, might otherwise have elicited divergent opinions, and the proceedings closed with an account of itineraries in Portuguese Congo, by the Rev. T. Lewis, who, from much experience as a missionary, pointed out some of the problems awaiting settlement in Africa, notably that of the native races, destined as they are to increase rapidly when slavery and native wars and superstitions are done away with.

Friday, September 13.—The morning was devoted to papers on

Scottish geography, the first being one by Mr. Scott-Elliot on the effects of vegetation on the valley and plains of the Clyde. Investigations of the kind, though second to none in importance and interest, have hitherto received too little attention in this country, and the inclusion in the programme of papers of this character was a step in the right direction, as showing the wide field for scientific inquiry open to the physical geographer in our own country. Mr. Scott-Elliot began by defining the general characters of the Clyde valley, and next traced the successive stages in the formation of the valley slopes, the important part played by vegetation in the process being pointed out. The varying constitution of the flat land was then explained, and the work done by various marsh plants in their formation described.

The next paper, by Miss M. Newbiggin, described a scheme that has been set on foot by the Scottish Natural History Society, at the suggestion of Sir John Murray, for the detailed investigation of the Forth valley; the object being the collection of such facts in regard to existing organic conditions in that valley as may supply a basis for accurate generalizations in the future. Prof. W. G. Smith then gave an account of the Botanical Survey of Scotland, begun by his brother, the late Mr. Robert Smith, whose early death has cut short a most promising career. We are glad to learn that the work so efficiently begun is being continued by Prof. Smith, who described to the meeting the main facts of botanical distribution in the areas represented by various sheets of the Ordnance Survey.

In the afternoon Dr. F. Moreno exhibited a fine series of lantern slides, illustrating chiefly the ethnology of the recently explored districts in the west and south of the Argentine Republic. He was followed by Mr. Hesketh Prichard, who dealt with the same region, describing his explorations last year in the neighbourhood of Lakes Buenos Aires and Argentino, as well as his descent of the Rio Leona, and the discovery of a lake which seems not to have been visited by previous travellers.

The proceedings closed with a short paper by Mr. Reclus Guyon on the map of the world, drawn on a surface correctly representing the natural curvature of the globe, to the construction of which Mr. Reclus has devoted so much time and attention during the past few years.

Monday, September 16.—In the first paper of the day, read on behalf of the author by Staff-Commander Dubois-Phillips, Captain C. Lemaire gave a summary of the valuable scientific results of the Belgian Expedition to the southern Congo basin, with the main outlines of which our readers are already familiar. Especial attention was called to the barometric determination of altitudes, on which an unusual amount of care was bestowed, and which have given results of especial value for the construction of a hypsometrical map of Central Africa. The methods adopted for the astronomical determinations of position and for the

magnetic, meteorological, and other observations were also described, as well as the general nature of the fauna and flora of the regions visited. After the paper, a selection from the extensive series of excellent photographs, taken during the expedition, was exhibited by the lantern, while a striking collection of water-colour drawings of plants and animals was also on view.

Dr. Vaughan Cornish read the first report of the committee appointed at the Bradford meeting for the study of terrestrial surface waves. During his visit to Canada in the winter of 1900–1901, Dr. Cornish found good opportunities for the study of the snow-surface with which the country was covered during the whole of the expedition; the results will be published in the *Journal* at a later date.

Mr. H. N. Dickson then read a paper on the mean temperature of the atmosphere and the causes of glacial periods, which will be printed in a subsequent number of the *Journal*.

In presenting the report of the Committee on the Survey of British Protectorates, Sir Thomas Holdich (whose paper was read in his absence by the Recorder) laid down the main principles which should be kept in view in any scheme adopted for the furtherance of the object stated. A discussion followed, in which Colonel Johnston, Director of the Ordnance Survey, Captain Deasy, and Mr. H. J. Mackinder took part. Sir T. Holdich's paper will be published in an early number of the *Journal*.

Mr. Mackinder then read a paper by Dr. Robert Bell, Director of the Geological Survey of Canada, on the "Geography and Resources of Northern Ontario," which will also be printed in the *Journal*.

Mr. A. L. Rotch, of the Blue Hill Observatory in the United States, described a method proposed for the exploration of the atmosphere at sea by means of kites. He pointed out the paucity of the material at present available for a knowledge of the conditions which prevail in the upper atmosphere over large areas, especially in the tropics. The difficulty in the way of obtaining data in the region of calms by means of kites, could be overcome, he showed, by the use of steamers, specially chartered for the purpose, the motion of which would create the wind necessary for the raising of the kites. Much could also be done by observers on board the regular ocean liners in the Atlantic and elsewhere.

Lastly, an interim report of the committee on changes of the land-level of the Phlegræan fields was presented on behalf of Mr. R. T. Günther, who is still in Italy carrying out investigations on the subject.

Tuesday, September 17.—Mr. W. N. Shaw gave an account of the weather maps issued by the principal countries of the world, and pointed out the comparatively limited area for which such maps are yet available. The rest of the morning papers were devoted to the subject of antarctic exploration, Professor Rücker, the President of the Association, being present, and taking part in the discussion which

followed. Dr. J. S. Keltie sketched the organization and plans of the National Antarctic Expedition, while Dr. H. R. Mill described the voyage to Madeira, and the various arrangements on board for the carrying out of scientific observations. Mr. W. S. Bruce then described the present position and proposed work of the Scottish Antarctic Expedition, of which he is leader, and which, he stated, would start for certain next year.

Mr. H. Yule Oldham gave a graphic description of his recent experimental demonstration of the curvature of the Earth's surface. Like that of Dr. A. R. Wallace in 1870, the experiment was carried out on the New Bedford river, the 6-mile stretch between Welney and Denver being selected.

Dr. R. Logan Jack read a paper, which will eventually be published in the *Journal*, on a journey through little-known parts of Sechuan, across the upper Yangtse, Mekong, and Salwin rivers to Burma. It was profusely illustrated with lantern views. A paper by Mr. Archibald Little, in which the possibilities of navigation through the gorges of the Yangtse were discussed, was read by Mrs. Little, and the proceedings of the section terminated with a demonstration, by M. Galeron of Paris, of the use of an ingenious celestial globe of which he is the inventor, which permits the movements of the heavenly bodies to be followed, as in nature, from within the sphere.

On Monday, September 16, in addition to the ordinary meeting of the section, a special conference was held, jointly with sections C and D, to consider the important scheme put forward by Sir John Murray and Mr. Lawrence Pullar for the scientific study of lakes of the British Islands. Dr. H. R. Mill was in the chair. It is proposed to execute a thorough survey, extending over some years, which shall embrace not merely the geographical and morphological, but the biological and other scientific aspects of all the British lakes. It is hoped to secure the services of a competent staff of observers, and if successfully carried out the scheme should lead to the acquisition of most valuable results from the point of view of the various branches of science represented. The scheme is regarded as forming a fitting memorial to Mr. Frederick Pullar, whose lamented death has put a stop, for the time, to the work already begun. Letters were read from Sir John Murray and Prof. Bonney, after which Mr. Thompson (representing the Zoological section), Colonel Johnston, Director of the Ordnance Survey, Mr. B. N. Peach, Dr. H. R. Mill, and others, spoke of the importance of the proposed researches from many points of view. The proceedings terminated with the passing of a resolution expressing the gratification of the Conference at the decision to carry on the work, and its appreciation of the munificent support accorded to the project by Mr. Lawrence Pullar.

Papers with a more or less geographical bearing were read at several

of the other sections of the Association. That of geology has naturally most in common with geographical aims, and among the subjects dealt with were: "Perim Island, and its Relation to the Area of the Red Sea," by Miss C. A. Raisin; "The Artesian Water Supply in Queensland," by Dr. R. L. Jack; "Evidences of Ancient Glacier-dammed Lakes in the Cheviots," by Prof. P. F. Kendall and H. B. Muff. At the Zoological section various papers on coral islands were read, including one on the Maldives, by Mr. J. S. Gardiner, while the results of the latest researches on malaria were put before the section by Major Ross. The anthropological papers included accounts of various native races of South America and the Malay peninsula, in the latter case from the observations of the Skeat expedition, of which the leader himself was present; while the botanical section listened to several papers on distribution and regional botany.

Lastly, the Saturday evening lecture to artisans, by Mr. H. J. Mackinder, was distinctly geographical in character, and it is matter for satisfaction that the claims of geography were thus officially recognized by the Association in the choice of the lecturer. Mr. Mackinder took as his subject, "The Movements of Men by Land and Sea," showing the influence on human development exercised by the various means of locomotion, from the horse as used from the earliest ages by the nomads of the Asiatic steppes, to the various later uses of the wheel, culminating in the steam traffic by land and sea at the present day.

COLONEL ARNOLD'S MAP OF THE BARUE COUNTRY.*

The Barue country to the south of the lower Zambezi has, until quite recently, remained one of the least-known districts of Portuguese East Africa, and the accompanying map, based on a survey by Colonel Alfred J. Arnold during a recent visit to the country on behalf of the Portuguese authorities, therefore supplies new information of considerable value. Colonel Arnold visited the country with the special object of studying the relations of the native chiefs, but he also paid much attention to the general geography and resources of the country, and supplies the following notes to supplement the information contained in the map.

The expedition started from Masikesse on September 19, 1900, and proceeded north, crossing the Gairedzi river into the Barua country (Makombo's territory) on October 12. Beyond the frontier, a distance of some 16 miles had to be traversed on the high plateau before the descent to the comparatively low level of the Pungwe basin was made. The highlands (of an average height of 5000 feet) supply excellent

* Map, p. 560.

pasturage, while the slopes of the valleys are well wooded, and the lower levels are covered with rich alluvial soil well suited for the cultivation of sub-tropical products. The elevated tract of land is exceedingly well watered, feeding innumerable rivulets which never dry up in the driest season. It sinks gradually to the north to the level of the watershed between the Zambezi and Pungwe basins, its eastern edge running nearly due north and south. At the kraal of Katandiga the country falls to an elevation of about 2500 feet, the open veldt giving place to an undulating plain sloping gently to the south-east, dotted here and there with kopjes and well watered by streams descending from the plateau on the west. Here the palm reappears, but the vegetation in general consists of thin bush and mimosa, easily cleared for cultivation. The expedition crossed the watershed towards the Zambezi at an elevation of about 3000 feet. The streams which flow north to the Zambezi, except those fed by the hidden waters of the plateau, are intermittent mountain torrents, but the beds of the Mopa and other rivers showed that during the rains large bodies of water pass down to the Zambezi, and it is probable that the contour of the country would permit the storage of water for the supply of the whole countryside. On the watershed the soil is dry and scanty, but at Mungari becomes rich enough for the production of coffee, vanilla, rubber, etc. This continues to the exit of the Muira from the hills, after which for some miles the country is composed of deep rich vegetable soil.

The geological formation of the plateau appears to be similar to that of the country near Masikesse. Granite is visible only occasionally, the hills between the Gairedzi and Katandiga's kraal being for the most part composed of talcose schist interspersed with quartz veins. Further north the kopjes and visible rocks consist almost without exception of banded quartzite with quartz reefs, and this extensive formation seems to be the matrix whence comes the alluvial gold found in the lower reaches of streams running into the Zambezi. An expert examination of this district is much to be desired.

The flora is essentially sub-tropical. Big timber is rarely met with, though possibly that around Inyakafura might prove suitable for export. Landolphias were met with on rare occasions only. The grasses of the plateau are good, and would supply excellent grazing. At present the native cultivation is not extensive, but this may be ascribed to the unsettled state of the country. The climate as a whole is healthy. On the plateau it is dry, cool, and invigorating, and consistently temperate throughout the year. Even on the lower plains colonization by Europeans is, in Colonel Arnold's opinion, certainly possible—much more so than in the valleys of Manica. Even in the rains two or more dry sunny days intervene as a rule between the downpours, while the prevailing winds from the Indian ocean are cooling

and pleasant. The resources of the country include minerals (gold, iron, copper, coal, etc.), agricultural products (which could be made to include tea, coffee, cotton, indigo, cacao, tobacco, vanilla, etc.), and those derived from cattle-rearing.

Colonel Arnold found the chieftaincy of the country in dispute between two rival claimants, each of whom called himself the Makombe. He considers, however, that Shupatora, the lawful successor, according to the customs of the country, though not the son, of the late king, is decidedly the more influential, his rival Nkanga (son of the late chief) having lost ground during the past five years. The disturbances which have prevailed within recent years in the Barue country seem to have caused an efflux of population, which is now estimated at 20,000 only.

THE MEAN TEMPERATURE OF THE ATMOSPHERE AND THE CAUSES OF GLACIAL PERIODS.*

By H. N. DICKSON, B.Sc.

It is not proposed, in this paper, to add another to the ever-lengthening list of theories which attempt to account for the occurrence of glacial periods. My object is rather to point out some consequences which must follow if we adopt certain of the theories still on trial, in the belief that some meteorological considerations, which I believe to have been insufficiently noticed, although hinted at by Howorth, Davis, and others, may help us in making a selection amongst the suggested theories, and thereby at least reducing their number. My attention has recently been drawn to this subject by Mr. F. W. Harmer, who has attempted to account for some features of the glaciation of the northern hemisphere by suggested changes in the normal distribution of barometric pressure.

It will be conceded that theories assuming an arrangement of climatic belts precisely similar to those existing at present, but symmetrically displaced through a given angle, must be abandoned. For example, the position which must have been occupied by a pole of cold, if we are by its means to explain the distribution of the permo-carboniferous glacial deposits in the southern hemisphere, so far as it has been ascertained, is unintelligible alike to the geologist and the physicist. It involves an antipodal area of cold and an antipodal ice-sheet, with intermediate areas of warmth, the existence of which is unrecognized; and it does not even account for many features observed in the deposits themselves. Again, it is almost impossible to conceive any physical cause which can have so displaced the climatic zones of the globe without producing effects which would leave behind them more formidable traces than those due to glaciation.

Leaving such hypotheses out of account, there remain two sources from which a possible explanation of glacial periods may be derived—

1. Tectonic changes, which may have either raised the region to be covered by an ice-sheet—or at least part of it—above the snow-line, or may have so altered

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* Paper read in Section E (Geography) at the Glasgow Meeting of the British Association, September, 1901.

the distribution of land and sea that the prevailing winds have changed their direction, and thereby caused lowering of temperature over certain areas sufficient to greatly lower the snow-line.

2. General lowering of the mean temperature of the atmosphere.

Firstly, tectonic changes.

It is difficult to suppose that the necessary lowering of temperature can have been produced by elevation alone. A great elevation and extension of the land area no doubt occurred during the Pliocene period, but its culmination was reached before the Pleistocene period, and J. Geikie states emphatically that glacial periods are characterized by submergence, and inter-glacial periods by emergence. Conceivably, the discrepancy in time may have been due to a species of lagging; the elevation of the land caused an ice-sheet to form gradually over it until the surface was depressed, isostatically, by the weight of accumulated ice and the cooling of the crust itself; then the increased temperature at the lower level caused melting of ice, relief from part of the weight, and consequent springing back to higher levels, when the weight of ice increased again; and so on, till the primary tectonic cause of elevation disappeared. But this seems more likely to assist in accounting for the smaller variations occurring during a great glacial period than for the main fact of the glacial period itself. The first elevation to the snow-line, even in fairly high latitudes, seems to involve vertical movements which in geographical relation and in scale are difficult to admit, and we must conclude that the effect of such movements as did occur cannot, in the first instance at least, have been direct.

The effect of elevation in extending the land areas must also be rejected as an efficient primary cause. It is true that if the land areas are extended continental conditions prevail over wider fields, and the winter temperatures are greatly reduced. But summer temperatures are correspondingly increased, and at the same time the precipitation in the form of snow is diminished by the anticyclonic conditions induced during winter. Hence we get nearly the same mean temperature, with less snowfall, and the occurrence of ice-sheets over such regions is contrary to experience: witness Siberia. Note here that these conditions are not to be confounded with the conditions of high pressure induced as the *effect* of an ice-sheet, as in Greenland, or, as seems probable, on the antarctic continent.

It has been argued that the extension of land surfaces might so alter the positions of the centres of high and low barometric pressure that glacial conditions might be induced by the change of direction of prevailing winds. We have already seen that the establishment of an ice-sheet within continental anticyclonic areas is unlikely. But if the land area is increased the sea area is diminished, and the ascending vortices or cyclones during the winter seasons must increase correspondingly in number and intensity in order to feed the increased volume of the descending currents over the land. The tendency would therefore be to increase the amount of condensation taking place within the cyclones, while their opportunity of penetrating into the land would be diminished rather than increased. Thus the proportion of cyclonic precipitation received on the land in the form of snow would be less, the total snowfall would probably not be increased, and, in any case, it would tend to be deposited on the eastern sides of the land areas rather than on the western. Finally, the ascending currents over the continental areas during summer would induce strong descending compensating currents over what was left of the oceans, which would then be occupied by enormously exaggerated systems analogous to our "Atlantic anticyclone," greatly raising the summer temperature of the maritime regions.

We are therefore led to inquire, secondly, whether the nature and distribution

of glacial phenomena, as they are at present known to us, can be more adequately accounted for by supposing a lowering of the mean temperature of the atmosphere as a whole to have taken place, and whether an adequate cause can be found which may have produced the necessary change of temperature.

The mean temperature of the air is determined by the ratio between the heat received by radiation from the sun, and that lost by radiation into space. Now, a change of mean temperature may be supposed to take place in two ways: every part of the atmosphere may undergo the same change, *i.e.* the atmosphere may be equally heated or cooled in all latitudes, the polar regions may be cooled or warmed more than the equatorial, or conversely. The effects of any change, direct or indirect, must evidently be very different according as it takes place in one or other of these ways. For if it occurs in the first, a genial climate in high latitudes must coincide with intense heat in the tropics, and a temperature climate in the tropics with intense cold in polar regions; but the temperature *gradient* from equator to pole must remain the same. The whole atmospheric circulation, and the consequent arrangement of the climatic belts, is, however, caused and determined by the difference of temperature between the equator and the poles, and there is no reason to suppose that a change in the absolute temperature would seriously modify either the form or intensity of the circulation, unless that change was very large. We should expect to find that evidences of climatic change in the past would adhere to parallels of latitude; traces of genial climate in high latitudes would go right round the parallels, and would correspond to an equatorial belt of intense heat, which, it may be supposed, would leave some record in the forms of animal or plant life; and traces of great cold in the higher latitudes (not necessarily in the form of ice-sheets) would correspond with belts of temperate climate in the tropics. It will be conceded that this does not satisfactorily agree with known facts.

Coming, then, to the case where the cooling is unequal, it seems scarcely worth while to seriously consider the case where the equatorial belt is cooled more than the polar. Such a change would explain no known fact, and imagination would be hard put to it to find even a possible explanation.

Suppose the lowering of the mean temperature to be due chiefly to cooling in the higher latitudes, the change at the equator being relatively slight. A comparatively small change in the total heat received and lost will then enable us to account for great cooling at the poles. A fall of 5° near the pole would mean a reduction of the mean temperature of, approximately, a little over 1°.

But a change of this kind involves other variations. The fall of temperature near the poles being greater than that near the equator, the equator-poleward temperature-gradient is increased. Now, according to the theory of Ferrel, if the whole atmosphere were at rest relatively to the Earth's surface, and if it were of uniform temperature, it would *remain* at rest. But if the equatorial regions have a higher temperature than the polar, a disturbing force arises which acts in the planes of the meridian, and causes an interchanging motion of the air-particles along those planes. On account of the Earth's rotation, a torsional force comes into play which causes a very great easterly velocity of the air in the higher latitudes, and a large, but considerably smaller westerly velocity in the lower latitudes, and the easterly velocity increases in proportion to the height above the surface of the Earth. The greater the temperature-gradient between the pole and the equator, the greater is the velocity of interchanging motion between the equatorial and polar regions, and the greater the torsional force which causes an easterly motion at the surface in the higher latitudes, and westerly motion in the lower; for the greater the velocity of interchanging motion, the faster a particle of

air settles down in the higher latitudes from a stratum where the velocity is greater to one where it is less, or the faster it rises up in the lower latitudes from a stratum where it is less to one where it is greater. Thus the acceleration of easterly velocity, positive or negative, is greater the greater the temperature-gradient, and consequently the greater is the force which overcomes the resistances, due to friction and inertia, to the east-and-west motions at the Earth's surface.

But, further, when the friction of the air moving over the Earth's surface is taken into account, we have the condition imposed that the moments of gyration of the air moving eastward must be equal to those of the air moving westward, otherwise there would be a tendency to change the velocity of the Earth's rotation. Any increase in the force causing the motions is likely to cause a displacement of the boundary between east-and-west motions at the surface, *i.e.* of the tropical belts of calms.

The net result is, then, that if we increase the difference of temperature between the equator and the poles, we increase the velocities of both the trade winds and the westerly winds of higher latitudes, and we displace the tropical high-pressure belts to positions nearer the equator.

Illustrations of changes of this kind may be derived from known conditions on the Earth's surface. During winter, the difference between the temperature at the equator and the north pole is nearly double what it is in summer, and the velocities are greater, although in a less ratio. Again, the mean velocities for the year, both of the trades and of the west winds, are greater in the southern hemisphere than in the northern, and the axes of the high-pressure belts lie in 30° S. and 35° N. respectively, more than can be accounted for by the displacement of the meteorological equator (due to other causes) to about 2° N.

Applying these results (which, it must be understood, are entirely qualitative, since our ignorance of the coefficients of friction depending on the distribution of land and sea, the nature of the land surfaces, etc., prevents definite numerical calculation) to the particular case of the northern hemisphere, we find that a lowering of the polar temperature has the effect of increasing the strength of the west wind circulation, and at the same time extending its influence at the surface to lower latitudes than is the case at present. The easterly currents, having necessarily a poleward component, *against* the temperature gradient, constantly tend to develop vortices or eddies—the familiar cyclones or depressions of these islands; and the stronger the current the more violent and frequent these cyclones are likely to be; under present conditions we find this in winter, contrary to what ought to happen if these systems were, as was once supposed, of purely convectional origin. But with the increased strength of the easterly current the relative influence of the continental land masses is diminished, and since at the same time the tropical belt of calms is displaced equatorward, the normal cyclone track will be displaced to lower latitudes, and will run more west to east instead of south-west to north-east, as at present.

With a general lowering of temperature, we might therefore have, in western Europe, a main cyclone track whose central axis would probably run from near the mouth of the English Channel eastward and only slightly northwards, to a point somewhere in the region of the Kara sea. North and west of this line, on the polar side of the depressions, an increased snowfall would be deposited during winter, and the cloudy conditions prevailing during summer would depress the temperature sufficiently to reduce the melting almost to vanishing point, even near sea-level. It is to be observed that in this region the prevailing cyclonic winds would then be from the east, a fact which may serve to explain some peculiarities of the

glaciation of the Scandinavian peninsula, and which accounts incidentally for the shell deposits of the Upper Crag on the east coast of England, at that time a lee shore.

Again, the north-easterly drift of surface water in the Atlantic would be greatly modified. This drift is at present most marked during the winter season, and its climatic effect is comparatively slight. During summer the Atlantic winds, although weaker in the higher latitudes, are more nearly west, and water is banked up against the European coast, escaping northwards and southwards in stream currents of very considerable volume. The northern branch of this stream current, which I have proposed to call the European stream, penetrates far northward, and melts large quantities of ice in the region north of Iceland and round Jan Mayen, the water flowing southward and westward as a surface current during autumn, covering over the warm waters of the European stream, and keeping up atmospheric pressure during early winter. The effect of this distribution, if strongly developed, as during the past winter, is to make the winter cyclones move more directly eastward into the heart of the continent. The modified movement of the cyclones suggested during the cold period would greatly increase this action, the whole of the Norwegian sea would be permanently flooded with cold water, and the surface movement along the European coast would be southward all the year round, a result predicted by J. Geikie.

As the cyclones penetrated eastwards, many of them no doubt following the line of the Mediterranean, the precipitation would diminish as the supply of vapour gave out, and sufficient snowfall to produce an ice-sheet would only be found at proportionally higher levels—following the results recently obtained in the Alps, the Carpathians, and the Balkans, by Penck, Cvijić, de Martonne, and others.

On the southern side of the cyclonic axis we should find a region of strong westerly wind and abundant rainfall, which would give a cool rainy climate to the whole of the Mediterranean region, extending into northern Africa, probably over a considerable part of the Sahara.

Thus for Eurasia generally, the difference from present conditions would be, more snow in north-western Europe, and rain in the south, the fall diminishing eastward until in the Asiatic regions the climate would be simply cooler, with smaller extremes of temperature, and more snow at greater elevations, as in the Himalaya.

Turning to North America, the cyclonic area would run more north-west to south-east, many of the depressions from the Pacific failing, as they do now, to cross the Rockies. In this case the western and south-western sides of the cyclones would afford more snow in proportion than in the cyclones of the Atlantic, and we should therefore expect to find the edge of the ice-sheet further south, at least near the eastern side. This is precisely the outline represented by Chamberlin and others, and it would be very difficult to account for it by an atmospheric circulation of any other type, unless, indeed, we suppose the glacial periods of Europe and North America not to have been simultaneous, a view which seems to raise more difficulties than it explains. Such cyclonic movements would also account for Gilbert's "moist periods," coinciding with the glacial period, in the region of Lake Bonneville and Lake Lahontan.

In the case of the southern hemisphere, the field of observation is of course much more limited, and it has not been so fully explored. A summary of what is known about permo-carboniferous glaciation in southern latitudes, published recently by Penck, is interesting in this connection. It appears that glacial action during that period has left traces in Victoria and New South Wales, Natal and the Transvaal, and possibly also in the Argentine, all in lat. 30° to 40° S., and

on the east sides of the land masses. The actual evidence of ice-action seems somewhat obscure, and the Gondwana Land question has relations to this part of the subject which I confess are far from clear to me. But if we suppose climatic changes to have taken place in the southern hemisphere in a manner analogous to those described in the northern, the Roaring Forties, which must then have attained a violence truly appalling, many have extended to within 20° of the equator, and the latitudes named would have come within the polar half of cyclones, which would deposit abundant snowfall on the eastern coasts.

Greater interest, perhaps, attaches to Penck's investigation, in the same paper, of the relative positions of the snow-line in South Australia and New Zealand during the quaternary glacial epoch and at the present time, which he shows to be almost precisely the same as those in the Pyrenees. This result, if extended by further research, goes a long way to show that the cold periods were of planetary and probably simultaneous origin, and that they were not primarily due to changes in the land or sea surfaces.

It is impossible here to go into the subject with more detail, but if the meteorological conclusions are correct, or even in the right direction, it seems that the assumption of a lowering of mean temperature, taking place chiefly by cooling in the polar regions, enables us to account for a glacial period by changes of temperature and of the distribution and amount of precipitation, considerably smaller than has been supposed. The increased strength of the planetary circulation is almost a necessary consequence of increased temperature gradient: the displacement of the tropical high-pressure belts is a matter of more uncertainty, for their position on the Earth's surface is dependent on friction to an extent which cannot at present be definitely ascertained by calculation. But if, from the analogy of the two hemispheres, we admit the occurrence of this displacement, it seems that the snowfall will be distributed in a way which will go far to account for the supposed positions of the ice-sheets.

The climatic changes accompanying a *rise* of temperature in the polar regions present some points of interest. The temperature-gradient becomes less steep, and the atmospheric circulation consequently less active, while the tropical high-pressure belt moves further from the equator. Hence the arid belts extend into somewhat higher latitudes; we may suppose the Mediterranean region to become one of intense drought like the Sahara. The geological evidence indicates that in Miocene times Spain had the present climate of Morocco. In the west wind region, the general movement is slower, and, the land and sea influences being relatively stronger, the contrast of oceanic and continental types of climate is increased. Thus on the whole the variation in latitude is diminished, and climate becomes more uniform over large areas. Over the Atlantic the stream currents would be weakened, and the surface movement would be of the drift type, northward along the European coast, with little melting of ice, and consequently warm surface water, a result again agreeing with Geikie's account of the inter-glacial periods. Over Europe the oceanic influence would be much more restricted to the western coast, and the continental climate would probably extend over the greater part of Germany and France, and perhaps also Sweden, a result again agreeing with Geikie, who remarks that during inter-glacial periods the climate of western Europe was that of a steppe. We might expect, from the direction of the main cyclone tracks, that during such a period the climate would in the higher latitudes be milder to north-east of the oceans, especially the Atlantic, than to north-west. I am not aware whether there is evidence of any such difference between, *e.g.*, eastern Greenland and Labrador, but it would suggest that the glaciation of north-eastern America would be more intense and protracted than elsewhere.

Until the question has been subjected to mathematical analysis, it is perhaps premature to attempt to apply the suggestions made to the surviving theories of the causes of glacial and genial periods. The chief point to which I would draw attention is the very small change of mean temperature necessary on the conditions assumed, and therefore the relatively small cause required to produce the desired effect. The occurrence of changes in the intensity of insolation, due to a change in the Earth's mean distance or the eccentricity of its orbit, or to a change in the value of the solar constant, seems very unlikely. It is difficult to say precisely what would be the effect of such a change on the temperature-gradient between the equator and the poles; but it seems probable that this would not alter much except for a large change of mean temperature, which, as we have seen, does not fit well with the facts.

Of the possible causes likely to give rise to large proportional changes in the gradient for a small change of mean temperature, two only need be mentioned: change of the obliquity of the ecliptic, and change of the transmission coefficients of the atmosphere for bright or dark rays. According to Stockwell's calculations, the mean value of the obliquity is nearly 23°·3, with a maximum of 24°·6, a minimum of 22°·0, and a period of about forty thousand years. At a period of maximum obliquity the pole gains about 5 per cent. on its present insolation, and the equator loses about one half per cent., corresponding to a warming of about 1°·6 C., and cooling of 0°·2 (or increase in the gradient 1°·8). An epoch of minimum obliquity corresponds to a cooling of 2°·7 C. at the pole, and warming of 0°·4 at the equator, or an increase of 3°·1 compared to present conditions. But it is impossible to say how far those changes represent the actual variation of gradient at the Earth's surface; the change would probably be greatly increased by the lowering of summer temperature due to increased cloudiness. In any case, however, it seems, from what has gone before, that the range of temperature-variation, although small, is at least of the order of magnitude required.

The effect of a slight change in the transmissive coefficient of the atmosphere, in altering the equator-poleward temperature-gradient, is very great. Assuming the present value to be about 0·6, the Earth receives (in arbitrary units) 170·2 at the equator, and 28·4, or less than one-sixth, at the pole. If the value is increased to 0·7, the equator receives 209·2 and the pole 45·0, or nearly one-quarter as much. L. de Marchi has worked out the temperature-change produced by a reduction of value from 0·6 to 0·54 for oceanic and continental climates, and finds an increase or gradient of 4°·7 C. for continental regions, and 1°·8 for oceanic. These again seem to be of the order of magnitude required.

The question remains as to how far such a change in the coefficient is likely to have taken place, and what cause or causes can be assigned for it. Any alteration in the transmissive power of the atmosphere for bright solar rays is very unlikely, but a change in the amount of water-vapour or carbonic acid would produce marked variation in the transmission of dark rays, these substances being nearly opaque to long-wave radiations. Thus, if the quantity of carbonic acid in the atmosphere increases, the temperature of the ground and of the lower atmospheric strata will be raised, till the increase of radiation into space has restored equilibrium between gain and loss of heat. Aqueous vapour, although it possesses similar properties, is unable itself to produce any radical change of temperature, for the quantity of aqueous vapour in the atmosphere depends on the temperature of the air; if the temperature be lowered by some other cause, as by radiation, the vapour is partly condensed and its protecting powers diminished—then the increased radiation again causes further condensation, and so on.

Arrhenius has calculated the probable departures from present atmospheric

temperatures which would be caused by multiple changes in the present amount of carbonic acid. If the amount of carbonic acid were reduced to two-thirds, this would represent a fall of temperature of about 3°·1 C. in all latitudes from the equator to at least 65°. If the amount were trebled, temperature would rise about 7°·3 at the equator, and 9°·3 in lat. 65°. Thus we have, with a rise of temperature, a marked diminution of the temperature-gradient, but with a fall of the order required the gradient remains much the same. But if we take into account the corresponding changes in aqueous vapour, and especially the changes which would be induced in the amount of cloud, there are many reasons to suppose that not only would the total effect of a given variation in the amount of carbonic acid be much greater than that represented, but the effect of a diminution would be to considerably increase the temperature gradient.

The amount of carbonic acid in the atmosphere at the present time is represented by about 45 parts in 100,000 (by weight), and Hogbom finds that agencies now at work on the Earth's surface are capable of producing or absorbing, in a single year, quantities which form a not unimportant fraction of this amount. But a serious increase in the total carbonic acid necessary to produce a given change in the atmosphere results from the fact that of all carbonic acid set free, the ocean absorbs nearly five-sixths. Chamberlin, and more recently Ekholm, have discussed the question from a geological point of view, and believe that liberation and absorption of carbonic acid may actually have taken place on the scale required; and Ekholm has even formulated a scheme showing alternate liberation and absorption, and consequent succession of warm and cold periods.

REVIEWS.

ASIA.

Khurasan and Sistan.*

In 'Northern Afghanistan' Colonel Yate gave an account of Afghan-Turkestan from Kabul to Herat. In this volume he carries the narrative further west into Persia, and describes the north-eastern provinces of that country from the Kurd and Turkoman country along the Russian frontier to the north down to the confines of Baluchistan on the Indian frontier to the south. He also gives an account of a stay among the Goklan and Yamut Turkomans, "hitherto comparatively unknown," as well as of a trip to the source of the river Gurgan, "never before visited by any European traveller." Colonel Yate also has a good deal to tell of the Afghan and Persian soldiery, of the official and commercial sides of Persian life, of the recent changes in Persian society, and of certain of the notable sights of the country of the Lion and Sun, especially the shrine of Imam Raza at Mashhad, the tomb of Omar Khaiyam, and the turquoise-mines at Madan. The Russo-Afghan frontier is also described in chapter ii., the Russo-Persian frontier in chapter iii., the Persian-Afghan border in chapter ix., Astarabad and the Caspian in chapter xvi. Three years' experience as British Consul-General at Mashhad gave the author his opportunity, and he has used it with great industry and patience, as well as with admirable temper and good sense. It might have made the volume more interesting to its general reader if a stricter selection had been observed in the narratives of social functions and of excursions to the more obscure Persian localities; but Colonel Yate professes to write with the special object of helping brother officers in the

* 'Khurasan and Sistan.' By Lieut.-Colonel Yate. Blackwood. 1901.

Indian army "who may think of visiting Khurasan and Sistan, or who may take an interest in Central Asia," and for this purpose his book is no doubt well adapted. Every educated man must read with interest the graphic account here given of Mashhad itself, of its antiquities, its shrines, and its festivals; every "decadent" will be shocked to hear of the Persian neglect of Omar Khaiyam's grave and memory; every lover of a good story will be delighted to hear the author's confirmation of the classic tale of Afghan cavalry fitting themselves out in cast-off coats of guards and ticket-collectors of the South-Eastern and Metropolitan Railways.

Western China.*

This record of travel on the Tibetan border professes not to make any addition to geographical exploration, but simply to give a picture of "China among the mountains, far removed from Western influence." "No newspapers, no public post, no roads beyond foot-trails, no street-cleaning, no drains, no fires in winter, and no ice in summer,"—these are the drawbacks of the Highland China, in which Mr. Little has been travelling; and over against them is a brilliancy of costume such as might have been found in mediæval or sixteenth-century Europe,—"all but the very poorest being richly and gracefully clad,"—an exquisite harmony of simple buildings with grand surroundings, a picturesque agreement of man with nature. Mr. Little's chapters originally appeared in the *North China Herald*, and are now republished with fifteen excellent photographic illustrations. The map is copied from Mrs. Bishop's. Starting from Chung-King, on the upper Yang-tse, Mr. Little's journeys show three main lines of travel westwards to the frontier of Tibet—one up the valley of the Fo-Kiang; one by the basins of the Chung-Kiang and Min-Kiang; and one by Kiating-fu, Mount Omi itself, and Yachau. The whole work, in other words, is devoted to Sechuan province, and forms a useful parallel to Mrs. Bishop's volume on the same region. The two authors are practically in agreement in their enthusiasm for it, as the loveliest, most prosperous, and pleasantest part of China. Unfortunately, of late years various causes have led to the exhibition of a very different feeling towards Europeans, Mr. Little notes, from what was the case ten years before. "Then one never heard an uncivil word, now one is constantly jeered by the rabble," he complains; "whatever be the cause, the temper of the people is entirely changed for the worse, and successful rioting has deeply lowered the prestige we formerly enjoyed." The firm hold which Buddhism has taken of this highland section of the Chinese race is equally emphasized both by Mrs. Bishop and Mr. Little, but the latter is more political in his outlook on Tibet. "Our countrymen in India need" it "as a real sanatorium;" and the recall of the Macaulay mission, when it had advanced within three days of Lhassa and routed the natives with some slaughter, is deeply regretted by the author, who thinks China, "at least in the Tibetan question," a pure *quantité négligeable*.

Kamchatka. By H. V. Sliunin.

These two volumes in Russian ('Okhotsko-Kamtchatskii Krai, yestestvenno-istoritcheskoe Opisanie,' or 'The Okhotsk-Kamchatka Region, a natural-historical description,' by Dr. H. V. Sliunin; with a map, 32 photographs, and 54 zincographs, St. Petersburg, 1900) are probably the most complete and valuable work ever published on the far North-East of Asia. It is no secret that M. Witte, who, as Minister of Finance, may be said to direct the main activities of Russian material progress, takes great interest in the development of these regions; and

* 'Mount Omi and Beyond.' By Archibald Little. Heinemann. 1901.

the recent announcement of the new railway to be built from Irkutsk to Yakutsk, which may possibly be continued in course of time to Behring straits, lends interest to the present study. In 1895–98 M. Sliunin, as representative of the Ministry of Finance, took part in the Kamchatka-Okhotsk expedition, sent out by the Russian Government, with the object of studying the whole of these immense regions in their economical and ethnographical aspects. The journey occupied three years, and the itinerary is marked in red upon the general map accompanying these volumes. Herein, then, for the first time we have an adequate and even exhaustive treatment of the countries once forming the sole Pacific seaboard of Russia, and Dr. Sliunin may be warmly congratulated on the result. Russian colonization has hitherto affected Kamchatka and Okhotsk but slightly; in the present volume, therefore, besides the natural features, fauna, and flora, it is the native types which are principally noticed as representing human settlement in these lands. The illustrations of people, dwellings, garments, hand-made articles, etc., are excellent; while the map bears evidence of the most careful preparation, and both from its size and style must rank, we suppose, above any other cartographical guide to the wild rocky lands around the Sea of Okhotsk. But for that intervening lake-like mass of inhospitable sea, Kamchatka would long ago have been touched by the new movements which are making a second Russia in Northern Asia; Dr. Sliunin's map shows us the chief barriers to its civilization at a glance; and the letterpress of his travels and observations demonstrates the care with which Russians are now studying the most arctic and inaccessible of their Asiatic possessions.

Dr. Futterer's Journey through Asia.*

This first volume (pp. xxv., 545) of 'Erfahrungen, Forschungen, und Sammlungen' is devoted to an account of the author's journey, in company with Dr. Holderer, from the Caspian to the Pacific, and forms, in his own words, a series of *Geographische Charakter-Bilder*. It is illustrated by 203 photographs in the text, 40 separate plates, several elevation plans showing portions of the route, and a general map, in which the whole of the itinerary, from Karlsruhe to Shanghai, is marked with a sufficiently clear red line on a rather sketchy and indistinct chart.

Dr. Futterer's route, after leaving Osh in Ferghanah and the comparatively settled districts of Russian Turkestan, lay over the Terek-Davan pass, through Kashgar, along the valley of the Tarim, by way of Aksu, Karashar, Turfan and Hami, across the Gobi desert from Hami to Su-cheu, along the Great Wall to Liang-Chu, thence to the Koko-Nor district, across the uppermost waters of the Ho-ang-ho, through North-Eastern Tibet, and so down to Singanfu, Han-kau, and the mouth of the Yang-tse. This most interesting and important journey is admirably illustrated by one of the best and most judiciously selected series of Asiatic views and types that could be readily found; and in general it forms no unworthy parallel to the work of Sven Hedin. Especially noteworthy are the chapters on the northern valley of the Tarim and the Eastern Thian-shan, on the Gobi in its central portion between the Barkul-Hami oasis and the end of the Great Wall, on the Koko-Nor district, and on the mountainous region between Koko-Nor and the King-ho (chaps. iv., v., vi., vii., viii.). Great attention has been paid to describing and illustrating the geology and zoology, as well as the geography and anthropology, of the countries traversed. The lucidity of the text, the scientific and appreciative spirit evident throughout, is no less admirable than the clearness and representative character of the illustrations. In every respect, except, indeed,

* 'Durch Asien.' By Dr. K. Futterer. Reimer. 1901.

the *Uebersichts-Karte*, this is a travel-record of the first class, and must reflect the highest honour on the expedition itself, on the government of the Grand Duchy of Baden, to whose support the enterprise was largely due, and to the German spirit of watchful enterprise in which the whole was planned and executed. It has been said that books of travel rarely attain to literary form; in the present volume, scarcely less than in those of Sven Hedin, an excellent natural style reinforces the inherent interest and value of the subject-matter.

Deasy's 'Tibet and Chinese Turkestan.'*

Captain Deasy's book possesses a twofold value. The plain unvarnished tale of travel and adventure, told with soldierly reticence, must always have a fascination for that ever-increasing section of Britain's young manhood which daily deplores the ever-decreasing area of the world's *terra incognita*. But apart from this, and beyond it, there is the value of a thoroughly scientific investigation into the geographical conditions of one of the most difficult and remote of those regions in High Asia which (difficult and remote though they may be) have yet a practical interest to the supervisors of our political machinery. This particular region contains a political nut which must sooner or later be cracked by that machinery, and it is satisfactory to think that for once (thanks to Captain Deasy's indomitable perseverance) there is no geographical haze to obscure the cracking of it. The Pamir Boundary Commission settled a good deal of the Russo-Afghan boundary question, but it had nothing to do with the Russo-Chinese line of division which was closely connected therewith, nor did it decide where Kashmir (representing British interests) ends and China begins. Consequently Captain Deasy, in that portion of his work which covers this inaccessible no man's land, has geographically (as well as graphically) illustrated a corner of Asia which directly touches our political sensibilities on a somewhat tender spot. The political value of the book, therefore, is to a great extent concentrated in the map which accompanies it. This is no mere illustration of an adventurous journey selected from the great mass of incomplete mapping which already existed. It is a brand-new geographical representation of those districts wherein lies the trijunction of three great Empires, and, as such, it is an invaluable addition to our politico-geographical knowledge. The book tells us how the map was made, and, so far as it reveals the secret of Captain Deasy's success, it is well worth the attentive study of all amateur geographers who essay to fill in spaces between those outlines which have been already traced across the globe by the feet of pioneers of the past. The great network formed by the trodden paths of first explorers is rapidly reducing the size of its mesh, and the unfilled spaces require far more scientific effort on the part of practical geographers than did the old route surveys of bygone days. We owe much, therefore, to such scientific explorers as Sven Hedin and Deasy, who prove the advantage of careful preliminary study, and show us how possible it is, even under circumstances of the greatest difficulty, to retain a sound and well-assured basis of fixed positions whereon to hang the patchwork of their mapping. The text of the book (which is excellently illustrated) comprises a faithful account (a little too much in the "diary" form perhaps) of a long and patient struggle against difficulties of all sorts—difficulties of Tibetan officialism, of climatic unpleasantness, of sheer physical obstruction, of weariness and starvation. Captain Deasy waded through them all successfully, and has contributed a record at the end of his travels which comprises not only an interesting tale of adventure and

* 'In Tibet and Chinese Turkestan, being the Record of Three Years' Exploration.' By Captain H. H. P. Deasy. Fisher Unwin. 1901.

an excellent illustration of the extraordinary physiography of a most remarkable region, but also furnishes us with an outline of well-constructed and thoroughly sound geographical mapping which has earned for its author the highest distinction which the Royal Geographical Society can bestow.

T. H. H.

THE ANTARCTIC.

Mr. Bernacchi on the Southern Cross Antarctic Expedition.

Mr. Louis Bernacchi, who recently communicated to the Royal Geographical Society a paper on the scientific results of the *Southern Cross* Expedition, has given a fuller account of his experience on that expedition in a finely illustrated volume.* It gives a general account of the voyage of the *Southern Cross* and the wintering at Cape Adare, traversing the same ground as Mr. Borchgrevink's 'First on the Antarctic Continent,' but frequently containing valuable additions to our information, especially as regards the physical conditions of the ice and the nature of the rocks. Unfortunately, Mr. Bernacchi's somewhat hurried departure from this country in order to join the *Discovery* at Lyttelton prevented him from giving to the proofs the careful revision he had intended, and it is not unnatural in the circumstance that some slips have escaped correction.

If a criticism may be permitted, we would suggest that rather too much is made of the feelings and thoughts of the members of the expedition, and rather too little of the physical effects of the severe climate. Indeed, Mr. Bernacchi makes light of the discomforts of polar life, and neither he nor the majority of his companions seem to have suffered any injury from their exposure. It may be noted, however, that Mr. Hanson, the zoologist, died during the winter; Petersen, the first mate, died on the voyage home; and Dr. Klövstad, the surgeon, died soon after the return of the expedition—a mortality of three out of a total ship's company of thirty souls.

The full observations and working of the latitude and longitude taken by Mr. Colbeck at the farthest south point reached by Mr. Borchgrevink are given, and there is a short and interesting discussion of the methods of fixing latitude and longitude in the peculiar conditions of high polar latitudes. The methods of sledging are described in several places, and it is evident that the *Discovery* will be fortunate in possessing two men so experienced in sledge work as Lieut. Armitage and Mr. Bernacchi. It is unnecessary to refer to the author's original ideas as to the character of the great ice-barrier, as the earliest opportunity of putting them to the test will be afforded by the voyage of the *Discovery*, and until she has inquired into the question there are no data on which to found an argument.

The book is admirably illustrated. It contains a copy of Stanford's new antarctic map, a special chart of the route of the *Southern Cross*, and many useful diagrams. The photographs are very carefully selected; some of them are extremely beautiful, and give a vivid idea of the nature of the scenery of the ice-pack and of South Victoria Land.

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* 'To the South Polar Regions. Expedition of 1898–1900.' By Louis Bernacchi. Illustrated from photographs taken by the Author. London: Hurst & Blackett, Ltd. 1901.

MAP PROJECTIONS.*

Since the appearance of the last edition of the late Prof. Hughes' excellent little 'Treatise on the Construction of Maps,' now more than thirty years ago, no work has been published in this country of an exactly similar character, or that can be said to take its place, notwithstanding all that has been written on map projections of one kind and another. The more recent writers on this subject have, as a rule, dealt with some special projection, or if their works have been of a general nature, they have been either too elementary to be of much real practical value, or so advanced and elaborate that they are almost useless to those who are not highly skilled mathematicians. There has thus existed a long-felt need of a really good practical work on map projections which shall furnish all that is necessary for their construction, with clear explanations of the principles upon which they are based, expressed in language intelligible to one with a fair knowledge of mathematics, similar in character and scope to that already referred to, with certain alterations and additions as the lapse of time may have rendered necessary.

Mr. G. J. Morrison's little work to some extent meets this requirement, and it is the hope of the author that it will be of service "as a text-book to young students who do not require to go deeply into the subject, and as an elementary text-book to those whose profession requires them to master map projection in all its details, and to whom the more advanced text-books might at first be rather puzzling" (p. 110). To a certain degree there is no doubt that this will be the case, but it is to be regretted, from a practical standpoint, that it is not more complete on some important points, as it certainly might have been without any serious increase to the size.

The book consists altogether of one hundred and ten pages, and is divided into four chapters, the first of which is introductory, and deals with globes, maps, and map projections generally; the second is entitled "Map Projections considered popularly;" the third, "Map Projections considered mathematically;" and the fourth, "Projections of Small Areas." Chapters i. and ii. are necessarily elementary, although they contain some very sensible remarks, amongst which may be considered those on the importance of using globes for educational purposes; but in the two last chapters the student who is taking the matter up seriously, or the practical draughtsman, will find much that cannot fail to be of service to him. These deal in a more or less satisfactory manner with most of the projections in general use. The gnomonic projection is perhaps treated more satisfactorily here than in most works of the kind, and the method of construction is clearly described. This projection certainly deserves to be better understood and generally appreciated, for although, like all others, it has its drawbacks, yet it possesses the important feature that great circles appear upon it as straight lines. Charts of the oceans are now published upon this projection by the U.S. Hydrographic Department for laying down great-circle courses, which are afterwards readily transferred to the ordinary Mercator chart when it is required to do so. The stereographic projection comes in for a fair share of attention, although the method of construction might in some respects have been more clearly expressed, especially in the case of the projection upon the horizon of London (p. 53). Similar cases are given in other books, and many will doubtless consider that the method of construction usually

* 'Maps: their Uses and Construction. A short popular treatise on the advantages and defects of maps on various projections, followed by an outline of the principles involved in their construction.' By G. James Morrison, M.I.C.E., F.R.G.S. London: Edward Stanford. 1901. *Price 5s. net.*

described is to be preferred to that which Mr. Morrison gives, and is certainly more intelligible. The stereographic projection has several excellent features, and the distortion is not greater than in many others. Its geometry is extremely satisfactory, and as all circles on the sphere are represented by either straight lines, circles, or portions of circles, it is comparatively easy of construction when its principles are understood. Many will therefore probably find it difficult to agree with the author when he states "that it is more of a mathematical curiosity than a useful map projection" (p. 83). At any rate, those who have occasion to deal with problems connected with mathematical geography have long since learnt to appreciate its good points.

Mercator's projection is somewhat summarily dismissed, and the explanation of the principle upon which it is based is disappointing; for although it is stated that "a little consideration" of the imperfect description given will show that the degrees of latitude vary practically "as the secants of the latitude" (p. 68), it would surely have been better to have explained clearly why this is so. Then, again, no table of meridional parts is given by which to construct this projection. This need not have occupied more than two or three pages, and would certainly have increased the value of the work from a practical point of view. However, the same remark applies to other tables which are necessary for the construction of the projections described, such as the table giving the value of a degree of longitude upon each parallel of latitude, which is usually given with such works. None of these need have been long, and certainly a dozen additional pages would have contained all that were necessary.

The account of the various modifications of the conical projection (pp. 70–80) is good so far as it goes, but it is far from complete, and nothing is said about the method of construction by diagonals, which is generally employed in maps for low latitudes, when the computed centre would fall at so great a distance as to render it practically impossible to describe a circle with compasses, and when curves of the radii are not obtainable. In connection with this projection, especially the table of the length of a degree of longitude on each parallel of latitude already referred to would have been a valuable addition, and enabled any one to construct it without having to refer to another work, which it will be now necessary to do.

The various forms of the elliptical projection might have been referred to, as some of these are useful for showing the physical features when it is desirable that the whole surface of the globe should appear on one map without the distortion occasioned by Mercator's projection.

In conclusion, however, it should be stated that Mr. Morrison's little book contains much useful information, and if in some respects it appears to be needlessly deficient, it is to be hoped that, in another edition which it may reasonably be expected will be called for before long, these deficiencies will be supplied, and the work rendered of more practical value than it is at present.

THE GERMAN ANTARCTIC EXPEDITION.

We have received an official communication from the Lords Commissioners of the Admiralty reporting the publication, in Germany, of an Imperial decree relative to the German South Polar Expedition. It is addressed by the Emperor to the Chancellor of the Empire, and is here reproduced as showing the status held by the German Expedition and its official recognition by the German Government. It runs as follows:—

"Dr. Erich von Drygalski, Professor in the University of Berlin, is appointed leader of the Expedition, which is to leave Kiel in August next, and proceed to the island of Kerguelen, where a magnetic and meteorological station is to be established. The journey to the south is then to be continued, the principal field of exploration being the Indo-Atlantic side of the South Polar Region. Should land be discovered which can be reached in this region, a scientific station is to be erected on it, and is to be kept going for a year if possible.

"The return journey should be attempted either in the spring of 1903, or, at latest, of 1904, as the leader of the Expedition may decide."

On the eve of the departure of the Expedition the following letter was addressed by Dr. von Drygalski to Sir Clements Markham, expressing his cordial wishes for the success of the work in which both nations are now engaged :—

"The *Gauss*, August 14, 1901.

"Dear Sir Clements Markham,

"The German South Polar Expedition cannot leave the mouth of the Elbe without once more sending its heartiest greetings and good wishes to yourself and the Royal Geographical Society, and through it to Captain Scott and the British South Polar Expedition. We thank you for the co-operation given to us throughout, and for the interest in our undertaking which you have shown in so high a degree, and which has frequently also taken practical shape in valuable help. We rejoice in the prospect of working in harmony with the British Expedition, and feel no doubt as to the result of this friendly co-operation. Good luck to the common labours throughout the whole undertaking; and to yourself and the Royal Geographical Society yet once more our hearty thanks for the cordial feelings constantly displayed, and our best wishes *auf Wiedersehen* when our work is accomplished!

"With best greetings,

"Ever yours truly,

"Erich von Drygalski."

THE MONTHLY RECORD.

EUROPE.

The Limits of the Cotteswold Hills.—A circular has been issued by the Cotteswold Naturalist's Field Club asking for information, especially from those who have been long resident near the outlying parts of the Cotteswold hills, as to the extent of the area to which the name is applied by the inhabitants. In addition to general information on the subject, specific information is asked on the following points. (1) Are the outliers, like Chosen, Robin's Wood, Oxenton, and Bredon hills, considered as parts of the Cotteswolds? (2) What is the southern

boundary of the hills? Do they extend below Bath? If so, how much? (3) What is the south-east boundary in the direction of Chippenham, Malmesbury, Cirencester, etc.? (4) Is Wychwood Forest, and are the districts around Burford, Witney, Chipping Norton, etc., considered as parts of the Cotteswolds? If so, what are the limits of this Oxfordshire tract to the east and north? If not, what are the limits of the Cotteswolds in this direction? Definitions of the following terms are desired: Oxford Downs, Vale of Berkeley, Vale of Gloucester, Vale of Evesham, Vale of Moreton, Vale of the White Horse. Also the name or names of the country between Bristol, the Avon, and the Vale of Berkeley. The inquiry is not merely of local interest, but should be valuable from the wider point of view of the bestowal of popular names generally on natural features covering considerable areas. For the full elucidation of the question it would be necessary, if possible, to determine how far the present-day usage has sprung up in the neighbourhood itself, and how far the local usage of the past may have been modified by the influence of literature. This, however, would be a matter of considerable difficulty. It is to be hoped that the results of the inquiry may be made accessible to the public. Information is to be sent to the hon. secretary of the club above mentioned, Mr. S. S. Buckman, of Charlton Kings, Cheltenham.

ASIA.

Periodic Fluctuations in the Level of Central Asiatic Lakes.—In the ninth number of *Petermanns Mitteilungen* for the present year, Dr. Woeikoff discusses the question of the fluctuations of level of the lakes of Central Asia from the Sea of Aral to the Baraba, and seeks to compare the results which might be deduced with respect to a periodic variation of climate, with the hypothesis of Brückner on the same subject. He points out that recent Russian investigations, such as those of Berg on the Sea of Aral (*ante*, p. 86), have indicated as probable that the fall in the level of the lakes in question, which had been thought to be in progress down to 1899, has now given place to an upward tendency. The information obtained by Berg from the local fishermen, who gave the years 1894–98 as the period in which the most marked rise took place, seems trustworthy by reason of the importance to his informants of closely watching the changes of level in the interests of their occupation. Similar evidence of a recent rise was found by Ignatof in lakes Teniz and Kurgaldshin in the Akmolinsk province, though here a trustworthy standard of comparison with former times was wanting. The Kirghiz, however, stated that a rise in the lakes began about twenty years ago, and had been especially rapid within the last few years. Similar facts are recorded with regard to lakes Dengiz, Teke, and Kizilkak, as well as the lakes of the Baraba. Wishing to trace the connection between this phenomenon and the meteorological conditions in the region in question, Dr. Woeikof examined the records for the town of Barnaul, for which a longer series is available than for almost any other Asiatic station. He found that as regards rainfall a 55-year period (wet to dry 26½ years, dry to wet 28½) seems indicated. The first wet period, however, falls some 12 years earlier than Brückner's (1850), and 8 years after his dry period (1830); the dry period falls 4–5 years after that of Brückner (1860), while the second and most important wet period is some 13 years later than his, occurring at a time reckoned by him as dry. This 55-year cycle, which is some 20 years longer than Brückner's, seems to coincide with the fluctuations of the lake-levels. As regards temperature, the cycles seem much shorter even than Brückner's, and have apparently no decided influence on the fluctuations of the lakes.

Magnetic Survey of India.—It has lately been announced that the Indian Government has decided to carry out a magnetic survey of India on the lines

suggested by the Royal Society. In addition to the existing observatories at Bombay and Calcutta, others are being constructed at Dehra Dun, Kodaikanal, and Rangoon. The investigations will be carried out by the Survey and Meteorological Departments jointly, under the direction of Colonel Gore and Mr. John Eliot. Field work, to be commenced in Scind and the Punjab, will be directed by Captain Fraser, R.E.

The Survey of Ceylon.—In his report on the work of the Survey Department of Ceylon during 1900, Mr. Grinlinton states that the Topographical Survey covered during the year an area of over 4000 square miles, which largely exceeds that dealt with in any of the previous years since the organization of the survey. This is due both to the fact that there was on the whole less detail to insert, and to the experience gained in the past by the surveyors and officers. The areas dealt with were in the Trincomali district, the eastern part of the North Central Province, the part of the Eastern Province which extends from Trincomali towards the province of Uva, and the eastern or low country portion of Uva. In carrying out the survey, it is impossible, it is pointed out, to avoid missing both natural features and old irrigation works in a practically unknown country covered with dense vegetation, but it is believed that nothing of importance has escaped notice. Good progress has also been made with the trigonometrical work, the secondary triangulation of the south-east of the island being now completed, while work is being carried on in the north-west, by which it is hoped that a large gap in the work will be closed up. When this is done, only the north-east corner of the island will remain to be dealt with. Mr. Grinlinton prospected this in 1898, and found that it could only be carried out by a traverse. In addition to these surveys, cadastral work and various special surveys were executed, bringing up the total surveyed and mapped during the past four years to over 10,000 square miles, out of a total of 25,000. The special reports by officers on particular portions of the work contain matter of much interest. Thus Mr. Blair, in describing the survey of the Trincomali district, which dealt almost entirely with jungle-covered country, describes the remains of ancient irrigation tanks discovered in the now uninhabited block of 300 square miles between the roads from Trincomali to Anuradhapura and Dambulla. Many of these are in the basins of the Yan-oya and Pankulam-oya or Kal-aru rivers, by the water of which not a single field is now cultivated. The restoration of some of these is well worthy of consideration. Mr. Halliley describes the discovery of the site of an ancient town or stronghold on the top of Newaragala, close to Maha-oya, with a magnificent reservoir cut out of the solid rock, and measuring 80 feet by 50, with a depth of 5 feet, the labour of cutting which must have been enormous. A road, still the only means of access to the top, zigzags up the cliff with a uniform gradient secured by the construction in one place of a stone retaining wall, in others of a viaduct. On the three other sides the place is inaccessible even to monkeys. The report shows the progress of the survey by means of maps, and two comparative plans of Colombo are given, one from an eighteenth-century drawing received from the Hague, the other as it was in January, 1901.

Kozloff's Expedition in Central Asia.—We learn from *Petermanns Mitteilungen* that the report of a disaster to the Kozloff Expedition has happily not been confirmed. According to news received at the Russian Geographical Society from the Russian Embassy at Peking, Kozloff returned on June 26 to Tsaidam, where he found the depôt left by him in the previous year in good condition. From his winter quarters in the neighbourhood of Chiamdo, in Eastern Tibet, he had made his way by new routes to the lakes at the source of the Hwang Ho, which had been already visited by the expedition in 1900. The return journey

to Kiachta was to be begun early in August. Details as to the work done by the expedition in 1900 are given in the July number of *La Géographie* by M. Deniker, in continuation of the account noticed in the *Journal* for March last (p. 303), from letters addressed by the traveller to the Russian Imperial Geographical Society. In March the expedition started for Tsaidam, proceeding *viâ* Donkye to Koko-Nor. From Tsaidam, where a meteorological station was established, the expedition went south across the Burkhan Buddha range, which was crossed at an elevation of 14,800 feet. Lake Alik Nor was explored by means of a canvas boat, and found to have a depth of 100 feet. Animal life is very abundant on its banks. On June 19, the Amne Kor, the western extension of the Amne-machin of Prjevalsky, was crossed, after which the Orin Nor, or Russian lake, was reached at the point where the Hwang-ho makes its exit. This point is at the northern, not at the north-eastern, end of the lake. Kozloff traced the western shore to the point of entrance of the channel uniting it with the Charing Nor, while this latter was examined by Kaznakoff, who made almost the complete circuit of the lake. The two lakes are separated by a tract of hilly ground about 6 miles wide, and have high banks. The circuit of each is about 90 miles, and both contain several islands. The expedition then proceeded south to the upper Yangtse, which was crossed near Sogon Gomba, and at the time of writing his last letter Kozloff was at the village of Cherku, in about 33° N., 96° 20′ E., on the road from Sechuan to Lhasa.

AFRICA.

The Abyssinian Frontier Expeditions.—Majors Austin, Bright, and Garner, who left Omdurman in December on an expedition to Lake Rudolf, arrived at Mombasa early in September, after suffering great hardships during the journey. On the early portion of the route much swamp was met with, but on approaching Lake Rudolf the country became arid and deserted, and scarcity of water caused much difficulty. During the last two months the party subsisted almost entirely on the donkeys, and out of fifty-nine Sudanese only fourteen survived. Some good survey work was, however, done between the Sobat and the lake. Major Gwynn has also continued the survey of the frontier northwards from the Blue Nile, and the whole has now been mapped in detail, and a definite frontier line adopted.

M. Le Roux in Abyssinia.—A French explorer, M. Hugues le Roux, has lately returned to France from an expedition, undertaken early in the present year, to the western borders of Abyssinia, where he is said to have made discoveries of some importance. From Addis Abbaba he seems to have journeyed to Wallaga in company with Major Gwynn, but when that officer proceeded to Khartum, M. Le Roux undertook the exploration of the region of the Blue Nile. Descending the steep escarpment of the highlands, he reached the confluence of the Didessa and Blue Nile, the latter of which he states has hitherto been confounded with one of its tributaries, flowing in reality a degree further south than has been supposed. From this it would appear that the Abai must make a still greater bend to the south (below the points at which it was seen by D'Abbadie and Cecchi) than was shown in the map by Mr. Oscar Crosby, published in the July number of the *Journal*.* The whole section of the stream from the frontier of Gojam to the confluence of the Didessa was surveyed by M. Le Roux.

British South Africa.—A report has lately been issued by the British South

* The latitude of the Abai at this part of its course has been hitherto given as about 10½° N. Mr. Crosby placed the southernmost part of the newly discovered bend just north of 10°, or less than half a degree south of the course as formerly given. If M. Le Roux is correct in shifting it a degree south, it must approach very near, if it does not join, the Angar, hitherto supposed to join the Didessa above its confluence with the Blue Nile.

Africa Company on the administration of Rhodesia in 1898–1900, which presents a large amount of information on the recent progress and present position of affairs in that territory. In spite of the drawbacks caused by the war in South Africa, the two years under review have been marked on the whole by steady progress, and the report, which occupies nearly 400 pages, permits a clear idea to be gained of the advance which has been made by the introduction of settled administration together with roads, telegraphs, postal facilities, and the like. Especially welcome is the information respecting the outlying portions of the territory in North-Eastern and North-Western Rhodesia, in which the past three years have been a time of particularly rapid development. Maps of both these are given, showing the stations at present occupied, the post and telegraph offices, the roads and footpaths, and in the case of North-Eastern Rhodesia, the administrative divisions (districts) of the territory. In this latter a total of 840 miles of road has been made, the principal lines being the Stevenson road and its continuation to Mweru and Kazembe, with the branch roads from Fife to Kasama (headquarters of the Awemba district) and Mirongo between the upper Chambezi and the Loangwa; and the roads from Fort Jameson west to the Loangwa and south to the Portuguese frontier.* The postal service extends to nearly every portion of the territory. Ox transport has been introduced with complete success on the Tanganyika road, but it is only here that the conditions are yet entirely favourable. Mr. Codrington, the administrator, gives notes on the present condition of the native tribes, the total number of individuals being placed by a very rough estimate at 256,000. A marked improvement has set in in the Awemba country since the suppression of the native *régime* of massacre and mutilation. A complete change is said to have come over the character of the people, who seem likely before long to become industrious workers. The influence of the Arabs in the territory has now dwindled to absolute insignificance. The health of Europeans has of late been remarkably good, especially in the district around Fort Jameson. In North-Western Rhodesia six stations have been established, including one at the Victoria falls, which, under the name of Livingstone, will be the future headquarters of the Administration. Health conditions promise here, too, to be favourable. The postal routes cover a large part of the territory, and their extension to the remote camp at the source of the Kafue was contemplated. Rubber is the most valuable product, and much information as to the rubber trade was gleaned by Major Colin Harding, extracts from whose reports on his journeys to the headwaters of the Zambezi are given. In Southern Rhodesia, to the industrial progress and resources of which a special section is devoted, European cultivation has made a decided stride. Wheat has been tried experimentally, with success, in each district, and other promising crops are barley, oats, potatoes, tobacco, etc. Tea has been planted in the Melsetter district (south of Manica), and a company has been formed to start rubber plantations in the Sabi valley. Steps have been taken to plant trees throughout the country, and the reports are so far very satisfactory. A special report on the rubber industry, by Mr. Lyttelton Gell, which has also been printed separately, is included. It strongly urges legislation for the regulation and protection of the industry. Much progress has been made with the development of the system of roads, which has already reached a total of 2734 miles. Lastly, reference must be made to the official system of spelling of native names, which, though not quite consistent throughout,† will be of much use as tending to secure uniformity.

* An extension of the last to Tete is contemplated.

† *E.g.* we find Neozana and N*k*unzane, *Um*guza and *M*guzana, M*ch*abezi and M*tsh*eleli, Ngezi and Zambe*z*i. Among the forms adopted are Bulawayo, Matobe (hills), Kafukwe (river), Basutu, Matabele (tribes).

Explorations on the Northern Frontier of French Congo.—An expedition under M. Lesieur, some details respecting which are given in the August number of *La Géographie*, has introduced considerable modifications into the map of this part of West Africa, which has been known chiefly through the work of Crampel and Fourneau. The Campo, which in its lower course divides the Spanish territory from the Kamerun, has been shown to be identical with the Temboni of Fourneau, and the Ntem of Crampel, the latter of which names is in use by the natives during its whole course. The Kune of Crampel is its largest tributary. Its banks are high, and its course obstructed by rapids, so that it is useless as a means of access to the interior. The Benito (which has hitherto been supposed to receive the Ntem, or Temboni) is in reality a much smaller stream than the Campo. Its name Eyo has, since the dwellers on its banks have been driven seawards by the Fans, given place to that of Welen (Welie of Crampel). It too is useless for navigation. The Aina, or Ivindo, rises at a spot not far from the point where it was crossed for the last time by Crampel. It flows first north, then east, and finally, before joining the Ogowe, S.S.W. Its banks are often swampy. The Ja, which was reached by Crampel in 1888, at the northern limit of his route, at the village of Jambong, is placed much too far north on our maps. It passes from French to German territory, but re-enters the former, and finally joins the Aina under the name Jadie, as seen by Fourneau. The identity of the Ja and Jadie was affirmed by all the natives, and if this is correct the Ja, and not the Mayanga (of Fourneau), will be the main stream. The Ja is even said to be the main headstream of the Ivindo, being of more importance than the Aina.

Exploration of the Bali (French Congo).—M. Fondère has lately sent to the Paris Geographical Society a short account of an exploration of the Bali river by MM. Frédon and Cadenat, acting under his orders. The precise position in the Congo system of the Bali, the upper course of which has been known for some time through the journeys of Ponel, Perdrizet, and other travellers, has been a disputed point among African geographers, the theory having been suggested by M. Wauters that it belonged to the system of the Ubangi, while others regarded it as the upper course of the "Likuala aux Herbes." The probability of the latter view was decidedly shaken by the work of M. Jobit (*Journal*, vol. xvii. p. 73), and the contention of M. Wauters has now been sustained by the journey above alluded to. On January 3, 1901, MM. Frédon and Cadenat left Bania on the upper Sanga and struck east, reaching the Mbaere, a right-bank tributary of the Bali, on the 15th. This stream had a width of 35 yards, with a maximum depth of 10 feet, swampy banks, and a current of about 4 feet a second. The Bali was struck at the village of Bassali, where its width was 85 yards. It flowed amidst a chaos of granite rocks, but although everywhere obstructed by rapids, it was found possible to navigate it in canoes. Its course veered to the east, and thirty-nine days after the departure of the expedition the explorers found themselves at Loko, the highest point reached by Vangele on the Lobai, a tributary of the Ubangi. M. Fondère says that his recent surveys have confirmed the opinion of M. Jobit, as to the slight importance of the upper "Likuala aux herbes," which is merely the outlet of an almost inaccessible region of marshes. They have also enabled him to construct an improved map of the region between the Ubangi and Sanga, in which the geography as shown on former maps is entirely modified.

AMERICA.

Physiography of Eastern Canada.—An important study of the history of the development of the present surface features of New Brunswick and Nova Scotia (Acadia) has lately been made by Prof. R. A. Daly, who puts forward his

views as to the stages of that development in the *Bulletin* of the Museum of Comparative Zoology at Harvard College (Geol. Series, vol. v. No. 3). The writer begins by pointing out the essential unity of the Appalachian geological system, as regards axial trends, composition, and structure. By the labours of Davis and others, it has also been shown that the forms of sub-aërial erosion present remarkable analogies in New England, in the New Jersey-Pennsylvania region, and in the southern Appalachians, though hitherto the same parallelism has not been shown to extend to the Acadian portion of the system. In the present paper, therefore, Prof. Daly examines the question by a study of the erosion forms in Nova Scotia and adjacent portions of New Brunswick. He first describes the great topographic facets of the southern plateau and the southern New Brunswick highlands, and after considering the three hypotheses by which the erosion of such a region has been explained, concludes that these facets represent a peneplain of Cretaceous age, which has been deformed by arching and tilt, and modified by sub-aërial and glacial erosion, and by an intermediate drowning of the shore-line. Coming next to the lowlands, about the Bay of Fundy and in Central New Brunswick, he finds in these traces of a second peneplain of Tertiary age, which has likewise been subject to extensive modification, which is being continued at the present day by tidal scour and other agencies. Thus in both of the two main topographic features of Acadia, he finds that "the denudation was essentially sub-aërial, and referable to two chief cycles of geographic development." Finally, he endeavours to show by a table the striking parallel which can be drawn between the physiographic features of Acadia and New England, and which brings us a step nearer the establishment of the organic unity of the whole system from Georgia to the Gulf of St. Lawrence. The paper is illustrated by photographs showing clearly the main physiographic features of the country.

The Highest Summit of North America.—We have already referred (*Journal*, vol. xi. p. 70; xiii. p. 305) to recent American explorations on the headwaters of the Shushitna river, which have revealed the fact that the high peak towering among the mountains to the north is probably the highest summit in the whole of North America. Mr. Dickey, a prospector, who was the first American to obtain a sight of the peak, estimated the height as over 20,000 feet. While identifying it with the old Mount Bulshaia (Big mountain) of the Russians, Mr. Dickey christened the peak Mount McKinley, a felicitous choice, which will worthily commemorate for all time the murdered President of the United States. In a map given in the *Journal of the American Geographical Society* for 1898, to illustrate explorations carried out in 1897, the height was estimated, from data obtained by Mr. Eldridge of the U.S. Geological Survey, at 19,500 feet. This has since proved too low a figure, for during the summer of 1898 a careful triangulation was carried out by Mr. Robert Muldrow, during a new expedition of the Geological Survey. Mr. Muldrow describes the operations, with a sketch-map showing the position of the mountain and the angles observed, in the August number of the *National Geographic Magazine*. For the purpose of measurement, a stadia line was run up the Shushitna river, elevations as well as directions being determined by a transit instrument reading to minutes. From points on this line six angles for location and elevation were obtained upon the mountain, giving for the height figures varying from 20,069 to 20,874 feet, the weighted mean and adopted height being 20,464 feet. The position obtained was lat. 63° 5′ N., long. 151° 00′ W., the distance from the nearest point of observation being 43·4 miles.

The Length and Parallelism of South American Coasts.—Dr. Theodor Arldt has drawn on a Mercator's map the loxodromic lines between the outstanding or primary points of the South American coast, which he calls the principal coast

directions, and calculated their length and the angles they make with the meridian. He has repeated this for secondary and still minor prominences, and compared this distance from point to point with the total length of the coast between them, with the mean result that the coast is 1·4 times the distance from point to point. The whole coast-line amounts to 22,218 miles, which is over 2·4 times the minimum possible perimeter of 9110 miles. Dr. Arldt also calculates what he terms the parallelism of these point-to-point lines, denoted by P below, which he defines as the ratio between the sum of their projections on the lines between outstanding or primary points and the sum of their lengths. The coastal parallelism, denoted by Π below, he obtains by comparing the sum of the projections of these point-to-point lines divided by their ratio to the total coastal length between the points, with the sum of the point-to-point distances. This is naturally less than the former. He further calculates the deviation of the mean direction of the point-to-point lines from that of the lines joining the outstanding points; it is denoted by Δ′ below. A comparison between coastal directions and those of the chief ranges, valleys, and the 100-fathom line is made. The following table summarizes the results, which are published in the *Mitteilungen des Vereins für Erdkunde zu Leipzig*, 1900, pp. 27–115 :—

Type.	L = length measured from point to point.	D = average distance from point to point.	K = total length of coast.	G = ratio of total length of coast to point to point length.	P = parallelism of coastal directions.	Π = parallelism of coasts.	Π′ = ratio of parallelism of coast to parallelism of average coastal directions.	Δ′ = mean deviation of angle mean coast makes with the meridian, from that made by chief coastal directions.
	Miles.	Miles.	Miles.					
Longitudinal west coast, Pacific type	5914	39·8	8716	1·45	0·86	0·62	0·71	2·5
Transverse coast, Andean region in Goajira and Argentina	2835	61·6	3843	1·36	0·72	0·56	0·79	7·5
Longitudinal coast, Atlantic type, in Venezuela and Brazil ...	4708	67·2	6129	1·31	0·82	0·69	0·83	20·5
	7543	65·0	9972	1·32	0·78	0·64	0·82	15·5
Transverse coast of Guiana	2456	91·0	3530	1·44	0·89	0·66	0·73	4·0
Total Atlantic type, = East coast	9999	69·9	13,502	1·35	0·81	0·64	0·80	12·5
All South American coasts	15,913	54·5	22,218	1·39	0·83	0·64	0·77	9·0

AUSTRALASIA AND PACIFIC ISLANDS.

Prof. Baldwin Spencer's Expedition.—*Nature* quotes from the *Victorian Naturalist* the statement that on July 19 last, Prof. Baldwin Spencer announced that he had finished his work at Barrow creek, where six weeks had been spent

among the Kaitish and Ummatjera tribes, and was purposing to form the next main camp at Tennant's creek, about 150 miles further north. A large amount of ethnological material had been secured.

The Capital of the Australian Commonwealth.—In framing the constitution of the new commonwealth of Australia, the question of the future capital was, it will be remembered, left unsettled pending the thorough investigation of the suitability of the various sites, on behalf of which a claim for the honour might be put in. The inquiry was placed by royal commission in the hands of Mr. Alexander Oliver, President of the Land Appeal Court of New South Wales, who has since presented his report on the subject. By the Commonwealth of Australia Constitution Act, it was laid down that the seat of government should be in territory granted to or acquired by the commonwealth and in New South Wales, not less than 100 miles from Sydney, if that colony should become an original state. The territory in which such seat of government might be situated was to contain an area of not less than 100 square miles. Ambiguities in the interpretation of this section of the Bill caused preliminary difficulties, among them being the uncertainty whether the 100 miles was to be measured by the nearest road or in a direct line. These, however, were got over in time, and proposals from places in New South Wales fulfilling the required conditions were invited by advertisement. An unexpectedly large number of responses were elicited, no fewer than forty applications being received. Of the sites put forward, twenty-three were inspected, some of them as many as three times, while at fourteen sites public inquiries were held. Before stating the conclusions arrived at, Mr. Oliver sketches the conditions and considerations by which it seemed that the choice should be determined. Some of the principal were: (1) Position with regard to the denser populations of the colony, which was held to exclude sites north of the main western line; (2) accessibility, as determined by the three principal lines of railway south of the same line; (3) the possession of adequate sources of water-supply; (4) the presence of suitable climatic conditions, *e.g.* an equable temperature, bracing air, and exemption from moist sea-breezes; (5) the suitability of the ground for the building of a beautiful and commodious city. The claims of the various applicants are passed in review, and the following conclusions arrived at: Either of the three sites, Orange (or Canobolas), Yass, or Bombala-Eden (Southern Monaro), would be suitable for the required purpose. If the final selection is to be governed by considerations of cost of acquisition and present accessibility as between New South Wales and Victoria, Yass would take the first place, but the water resources here are not as satisfactory as could be desired. If soil and climate are regarded as controlling factors, Orange (or Canobolas) has the advantage, but the position of this is less favourable as regards cost of purchase, water-supply, and accessibility. Apart from cost and present accessibility, Southern Monaro combines more distinctively appropriate features than either of the others, and if regard be paid chiefly to the future, is entitled to take the first place. A separate volume of plans accompanies the report.

POLAR REGIONS.

The "Discovery."—The *Discovery* arrived at Cape Town on October 3, having *en route* touched at South Trinidad island, where, after some difficulty on account of the surf, a landing was effected by Captain Scott, Mr. Murray, and Dr. Koettlitz, who reached an altitude of over 1000 feet, and made an interesting collection of natural history objects. The ship afterwards proceeded to Simon's bay, whence, on October 14, she sailed for Lyttelton, N.Z., the proposed visit to Melbourne having been abandoned.

The Scottish Antarctic Expedition.—A statement as to the plans now adopted for the Scottish Antarctic Expedition was made by Mr. W. S. Bruce, the organizer and leader of the expedition, at the recent meeting of the British Association at Glasgow. Mr. Bruce last year sketched a preliminary scheme in the *Scottish Geographical Magazine*, according to which the expedition was to have extended over three years, while the programme included a wintering station in a high southern latitude. This has since been considerably modified. Funds have been subscribed, entirely by Scotsmen, sufficient for one complete year's work in the antarctic, but the idea of a winter station has been given up for various reasons. A free moving ship, constantly doing work on *Challenger-Valdivia* lines during a whole year, is, Mr. Bruce thinks, the greatest present need. Contours of land-areas will be determined, and geological, zoological, oceanographical, and meteorological research will be actively pursued during the whole voyage, while special land journeys of short duration will be undertaken as occasion arises. The outward route will be that indicated last year, viz. one passing from the Falkland islands to the south of South Georgia, and striking south in about 30° W. across the Weddell sea. Here it is hoped to push southwards as far as is prudent without involving the risk of the ship being caught in the ice. Much importance will be attached to meteorological work, and stations in South Georgia and the far south will, if possible, be established. The Sigsbee and Lucas sounding-machines will be taken on board, and a special examination will be made of the region about 68° 34′ S., 12° 49′ W., where Ross obtained his much-disputed sounding of 4000 fathoms and no bottom. The extent of the great deep discovered by the *Valdivia* between Bouvet island and Enderby Land will also be a subject of investigation. On board there will be a permanent scientific staff of 5 men, and the marine biology of the antarctic, as well as all the observations essential to an oceanographical expedition, will receive careful attention. Mr. Bruce intends to purchase a Scottish or Norwegian whaler of about 500 tons, and hopes to start in about September, 1902.

The Peary Expedition.—Extracts from the journal of Mr. H. L. Bridgman during the voyage of the *Erik* to Peary's headquarters in the far north, are printed in the Brooklyn *Standard Union* of September 29. The quotations are somewhat disconnected, so that it is somewhat difficult to obtain a complete outline of the events of the voyage, but the following particulars supplement the accounts previously published. The *Erik* had on the whole a fair passage across Melville bay, though on two occasions the advance was all but given up, owing to obstruction by the ice. At Cape York, which was reached three days after leaving Upernavik, the first tidings of the *Windward* and her crew were obtained, it being ascertained that the ship had wintered in safety on the west side of Smith sound. The meeting seems to have taken place during Peary's absence at Olrik's bay, to the neighbourhood of which Mr. Bridgman, to judge from the fragments of his journal published, proceeded in the *Windward* for the purpose of hunting caribou, which abounds on the peninsula between Olrik's bay and Academy bay. Here communication was opened with Peary on or about August 19, though whether this was the first occasion on which the parties had met is not made clear. Since the arrival of the *Erik*, as announced in our last number, the *Windward* also has arrived in southern waters, having put in at Brigus, Newfoundland, on September 26. She will sail again next year on her final voyage north in connection with the present expedition.

Baron Toll's Expedition.—According to news printed in *Petermanns Mitteilungen*, there seems a probability that Baron Toll may be forced to modify in some degree the programme of his expedition, owing to the partial failure of his

coaling arrangements. The Baron was obliged to push on last autumn from Jugor strait without waiting for the coaling-ship, and it is doubtful whether his supplies will allow him to push on to Sannikoff land, to winter there, and return *viâ* the Pacific. Lieut. Kolomeizeff reached Yeneseisk early in the summer, on a mission for the establishment of coal depôts at Dickson harbour at the mouth of the Yenesei and on the New Siberian islands, from which it appears that the Baron wishes to keep open a line of retreat to the west. Lieut. Kolomeizeff only succeeded in reaching the mouth of the Yanesei from the winter quarters on the third attempt.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Distribution of Volcanoes.—Since the map in Berghaus' atlas was prepared, many new discoveries, especially in Central Africa and Asia, have made a revision desirable. Dr. C. W. Wägler has published in the *Mitteilungen* of the Leipzig *Verein für Erdkunde* for 1900 two maps, showing the Pacific and its complementary hemisphere on a mean scale of 1 : 31,000,000, with the network drawn according to an "external stereographic" projection. On these he distinguishes volcanoes active in the nineteenth century, from those active within historic times, and from others, indicates fumaroles, mofettas and solfataras, mud volcanoes, geysirs, and hot springs as far as they can be shown on the maps, and marks the distribution of recent volcanic outpourings. He divides the world into (1) the Pacific basin; (2) the Indian-Antarctic basin; (3) the Atlantic area, round whose borders the volcanoes are grouped; and further subdivides these into minor basins. The letterpress accompanying the maps is rather scrappy. No tabular summary of the different kinds of volcanoes is given. The lists given in the text are usually fuller than the map, which, of course, is necessitated by the small scale of the latter. The South Pacific coast from Victoria Land to Graham's Land yet to be explored may have volcanoes, and in other parts of the world others may yet be discovered.

Geological Evidence for a South Pacific Continent.—Carl Burckhardt, one of the exploring geologists attached to the Museo de la Plata, has recently contributed a paper to the Revista of the Museum (vol. x. pp. 177 ff.) on this subject. He points out that between 32° and 39° S., the Chilean slopes and main crest of the Andes are formed of porphyritic conglomerates belonging to Upper Jurassic and perhaps in places to Cretaceous times, and are succeeded to the east by a belt of fine-grained sandstones and marls of exactly the same age as the conglomerates farther west. He considers that the latter indicate the presence of deeper waters, and the former the proximity of the western shore of the Upper Jurassic Andine gulf, which was bounded on the west by a continent whose eastern coast almost coincided with the present western coast of Chile. This continent he thinks long persisted, probably from the Devonian epoch, and may have extended to New Zealand and Australia, and this is supported by palæontological evidence, not merely in the similarities of the *glossopteris* floras, but also in the similarities of the recently studied plants of the Rhætic beds of these two now widely separated regions.

A New Formula for the Rate of Currents in Rivers.—At a recent meeting of the professional section of the Vienna Institute of Architects and Railway Engineers, Mr. Richard Siedek, of the Government Hydrographic Bureau, proposed a new formula for determining the speed of the current in rivers. The formula of Ganguillet and Kutter, which has been largely used since its introduction in 1877, has proved unsatisfactory when compared with the results of direct measurement by refined modern methods; discrepancies of as much as 60 per cent. having been recorded. Siedek has made use of much more ample material than Kutter had at his disposal. According to Dubuat's law, the power

producing the current in streams and channels depends solely on the slope of the surface, and opposed to this is the cross-section resistance of the bed of the channel. The new results indicate that the relation between the resistance and the velocity of the stream is nearly constant, and Siedek accordingly does not assign special coefficients of friction or resistance, as these are included in the assumed relations of slope and mean depth. In defining the cross-section of the stream, Siedek takes into account, besides the mean depth (T), the breadth at the surface of the water (B). This avoids the defect of Kutter's "Profile radius," which gave the same numerical values for, *e.g.*, a stream 9 feet deep and 12 feet wide and a stream 6 feet deep and 18 feet wide, and it embodies the results of the observations on the Elbe and Danube (1881), showing that with the same slope the current is faster the greater the depth. Since under normal conditions the breadth and depth of a river tend to increase as the slope diminishes, a given normal breadth (B) corresponds to a given normal depth (T) and slope (I), and the fundamental equation for the speed V′ of a normal stream becomes—

$$V' = \frac{T\sqrt{I}}{\sqrt{B}\sqrt{0{\cdot}001}}$$

When the conditions are not normal, the effect of abnormality in any one factor on each of the others must be allowed for. This can be best expressed in the form of corrections of the value of V′. Siedek's final formula for velocity V is as follows:—

$$V = V' + \frac{T - T_n}{\alpha} + \frac{I - I_n}{\beta(1 + I_n)} + \frac{T_n - T}{\gamma}$$

when T_n and I_n are the "normal" values corresponding to B, and α, β, γ are coefficients, the values of which are given in tables, depending on the actual slope and depth. One distinct advantage of Siedek's formula is its applicability to open or flood profiles, which do not require special computations as in the case of Kutter's expression. The accuracy of the new formula has been tested by comparison with 537 direct measurements on the Danube, Rhine, Elbe, Rhone and tributaries, and on tributaries of the Volga. The agreement is on the whole very satisfactory, the differences ranging from less than 5 cms. (2 inches) to a maximum of 20 cms. (8 inches) per second, and becoming less the wider the stream, partly because normal conditions are more nearly realized, and partly because the errors of measurement are relatively smaller. Further comparisons are in progress. At the end of his paper Siedek urges that a formula, however good, should only be used in cases where direct measurements are impossible. The paper appears in the *Zeitschrift des Oesterichischen Ingenieur- und Architekten-Vereins*, 1901, 23 and 26.

GENERAL.

New Geographical Publication.—The Geographical Association has issued the first number of a magazine devoted to the study of methods of geographical teaching, which has been for some time in contemplation. It is edited by Mr. A. W. Andrews and Dr. A. J. Herbertson, and will appear three times yearly, in February, June, and October. The magazine will be addressed primarily to teachers of geography, and besides discussing class-room and open-air methods of teaching, will contain articles on such subjects as ordnance maps, typical regions of the globe, especially in the British dominions, the great cities of the empire, and the various colonies. Geographical literature, maps, and appliances will also be reviewed from the teacher's point of view. The paper should prove of great value,

nothing of the kind having as yet been issued in this country, while in the still imperfect state of organization of geographical teaching, teachers are too often dependent on their own resources in carrying out their work. We hope, therefore, that the new venture will receive such support as may place it on a secure and permanent basis. The title of the magazine is *The Geographical Teacher*. It will be issued free to members of the Geographical Association, while by means of a guarantee fund raised mainly by members of that body, it is found possible to offer the magazine to the public at one shilling per copy. The first number is issued for October of the present year.

International Geographical Congress.—It is announced in the *National Geographical Magazine* that an acceptance of the invitation extended by the National Geographic Society to the International Geographical Congress, for its next meeting, has been received at Washington from Baron von Richthofen. The meeting will take place in 1904, and will be the first held outside Europe.

OBITUARY.

Lieut.-Colonel Seymour Vandeleur, D.S.O.

Another of the most promising workers in the field of African survey has fallen a victim to the Boer war in the person of Lieut.-Colonel Seymour Vandeleur, whose excellent work both in East and West Africa is well known to readers of the *Geographical Journal*. Like Captain Wellby, whose loss to the cause of geography we had to deplore last year, Colonel Vandeleur had shown himself a most zealous and painstaking surveyor, never allowing his interest in his work to flag even amidst the arduous conditions of a military campaign. It is with this side of his work that we are more particularly concerned as geographers, but the exceptionally rapid promotion which he gained during his twelve years' service in the army is a clear indication of the value set upon his services by the military authorities.

Seymour Vandeleur, eldest son of Hector Stewart Vandeleur, of Milrush and Cahiracon, County Clare, Lord-Lieutenant of that county, was born on July 11, 1869. From 1879 to 1882 he was educated at Farnborough School, whence he passed to Eton, entering the army class there, and afterwards passing straight to Sandhurst. He entered the Scots Guards in 1899. During the winter of 1893 he made a shooting tour in Somaliland and Abyssinia, and in the following year was seconded for service on the staff. He now found scope for more extended work in Africa, receiving an appointment under the Foreign Office in Uganda, whither he proceeded towards the end of 1894, remaining nearly two years, and taking part in the Ungoro, Nile, and Nandi expeditions. During the whole of his journeys he carried out extensive surveys, which for the first time supplied a fairly accurate basis for the detailed mapping of Uganda and neighbouring countries. He described his work to our Society in November, 1896, and in the following year its value was recognized by the award of the Murchison Grant. From Government he received the East African medals and clasps, together with the Distinguished Service Order.

Lieut. Vandeleur had not been many months in England when he received a new appointment, this time in West Africa, where during the winter of 1896–97 he was engaged in the military operations against the Sultans of Nupe and Ilorin, being again mentioned in despatches, and receiving the West African medal and clasps with the brevet rank of major. At the close of 1897 he was suddenly summoned to Egypt, where he served till 1899, being present at the battles of the Atbara and Omdurman, at the former of which he was slightly wounded. After a short period of service as A.D.C. to Lord Methuen, then commanding the Home

District, he went out to South Africa, where he was employed on special service, and received promotion as Deputy-Assistant Adjutant-General. He was severely wounded at Middelfontein, in January, 1901, and, being mentioned in Lord Roberts's despatches, was promoted to the rank of lieut.-colonel. He came to England on leave in the early summer of the present year, but returned to South Africa, and was killed at Waterval, on August 31, when on his way from Pretoria to Pietersburg to take over Colonel Grenfell's command. He had been transferred to the Irish Guards on the formation of the regiment in October, 1900.

Besides the papers printed in 1897 in the *Journal*, Colonel Vandeleur published, in 1898, a work entitled, 'Campaigning on the Upper Nile and Niger.'

General M. I. Venukoff.

The well-known Russian geographer, General Michael Ivanovich Venukoff, died in Paris on August 1 last, at the age of sixty-nine years. The deceased was born on July 5, 1832, at Nikitinskoye, in the Riazan government, and received his military education at what is now the Constantine Artillery School. He afterwards entered the Imperial University of St. Petersburg, and after completing his studies, travelled extensively in Russian Asia and adjoining regions, including the Amur, the Tian-Shan, Altai, and Caucasus (1857–1863). He subsequently undertook various journeys in other parts of the world, visiting at one time or another China, Japan, Asiatic Turkey, Algeria, Tunis, Senegal, Brazil, etc., spending some time in China and Japan in 1868–69. He was a copious writer, his publications including both books and articles in scientific and other periodicals. Of the former, the most important was, 'Travels on the Confines of Russian Asia,' published in Russian in 1868. General Venukoff had resided in Paris for some years before his death. He had been an Honorary Corresponding Member of our Society since 1886. A short sketch of his life, with portrait, appears in the *Deutsche Rundschau* for October.

Jakob Erhardt.

The veteran East African missionary, Jakob Erhardt, one of the zealous band by whose labours public attention was first directed, more than half a century ago, with results of such far-reaching importance, to the interior regions of Eastern Equatorial Africa, died in August last at Stuttgart, at an advanced age. Erhardt was associated with Krapf and Rebmann in the work entrusted to them by the Church Missionary Society, which commenced operations in East Africa in 1843, and he actively participated in their labours for a number of years. During their intercourse with the natives of the coast region and the Arab traders then pushing into the interior, the missionaries, as is well known, collected many reports on the geography of those mysterious regions, and it was to Erhardt that was due the first attempt at a cartographical representation of the facts which had been gleaned. This was published in the *Church Missionary Intelligencer* for 1855, and soon attracted wide attention. Rumours had reached the ears of the missionaries of the three great lakes of the interior, Nyasa, Tanganyika, and the Victoria Nyanza; and by combining these into a single lake, Erhardt obtained a huge inland sea of singular outline, which, if it had really existed, would have dwarfed the proportions of all the other freshwater lakes of the globe. It was to the interest aroused by this publication, which was repeated with some modifications in the second volume of the then newly started *Petermanns Mitteilungen*, that the ultimate despatch of the great expedition of Burton and Speke was largely due. Erhardt has long outlived his brother missionaries, Rebmann having died in 1876, and Krapf in 1881.

Prof. Josef Luksch.

On July 29 of this year there died at Brunn-am-Gebirge, near Vienna, the well-known physicist and oceanographer, Regierungsrath Prof. Josef Luksch.

The son of an artillery officer, Josef Luksch was born at Graz in 1836. He was educated at a military academy at Wiener Neustadt, and served on the active list from 1855 to 1866—after 1862 in the navy. After his retirement in 1866, he taught geography and history at the Royal Naval Academy at Fiume. In 1870 he resigned a post as examiner at the Vienna Technical School, and thereafter became professor at Fiume, retaining the chair till 1894. Prof. Luksch began oceanographical work in 1874 with an investigation of the waters of the Dalmatian coasts. This was followed by researches in the open waters of the Adriatic, and then came the great expeditions of the *Pola* in the eastern Mediterranean, the Ægean sea, and the Red sea. Geographical science is indebted to him for the examination of the depths and configuration of the bed of those seas, and for the collection of abundant data regarding the temperature and salinity of their waters. Luksch's special work, however, was the investigation of the optical properties of sea-water, which was remarkable not only for the abundance of the material discussed, but for the variety and accuracy of the methods employed. In 1879 Luksch published a map of the world showing the progress of discovery, and in 1882 he edited the oceanographical observations of the Austro-Hungarian Expedition to Jan Mayen. Many papers on his own observations are to be found in the publications of the Vienna Academy of Sciences.

Prof. Wilhelm Tomaschek.

Dr. Wilhelm Tomaschek, professor of historical geography at Vienna University, died suddenly of heart disease on September 9. Born at Olmütz, in Moravia, on May 26, 1841, he received his education at Vienna, becoming first teacher at the gymnasium, and after 1877 professor of geography at the University of Graz. In 1885 he was summoned to the chair of geography at Vienna University. Prof. Tomaschek's scholarship in the direction of philology and history was of a high order, and justifies a comparison of the Austrian *savant* with the late Heinrich Kiepert, though the former lacked the acquaintance with places at first hand and the qualifications as a cartographer possessed by the latter. His writings, for the most part published in the *Transactions of the Vienna Academy of Sciences*, were chiefly concerned with the historical geography of Western Asia and the Balkan peninsula. Among them may be cited his 'Topographical Commentary on the Voyage of Nearchus,' his contributions to the 'Historical Topography of Asia Minor during the Middle Ages,' his papers on "Sasun and the Source-Region of the Tigris," and on "Our Knowledge of the Hæmus Peninsula," and other writings of greater or less length.

CORRESPONDENCE.

Joris Carolus, Discoverer of Edge Island in 1614.

To my article under the above title, which appeared in the June, 1901, number of the *Geographical Journal*, the following facts should be added :—

In the Doge's Palace, and also in the Correr Museum at Venice, there are preserved two pairs of globes. Both (according to the signature on the celestial

globes) were made by "Guljelmus Cæsius, anno 1622." The representation of Spitsbergen on them is copied from Daniel's map in 'Histoire du Pays nommé Spitsberg,' but the names are altered in one or two cases, and the coast-line is continued in a north-easterly direction. Edge's island is not marked, but its place is approximately occupied by "Marsyn," which, as I have shown, was the name mistakenly applied to it by Carolus (though he miswrote it Morfyn). Marsyn is, of course, a miswriting of Matsyn.

At lat. 82° N.W. of the north-west corner of Spitsbergen, there is written on the globes, 'Hollandi huc usque fuerunt a° 1614." This, therefore, is another record of what I have shown to be Carolus' false claim to have attained that latitude in the year in question.

The names in the 'Hist. du pays Sp.' map are English, those on the globes are Dutch, and are as follows, in order from north to south :—

S. Maria Magdalene sond	Groenhaven
Ghebrokeland	Koudeherberg
Schoonvoorland	Kloksond
Engelschebay (King's bay)	Belsond
Keerwyk	Schoonhaven
Behoudenhaven	Hoornbaye
Yssond	Suydhoeck

Vogelhoeck is marked at the north end of Kyn Eyl.

MARTIN CONWAY.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Bosnia and Herzegovina. **Nikashinovich.**

Bosnien und die Herzegovina unter der Verwaltung der österreichisch-ungarischen Monarchie und die österr.-ungar. Balkanpolitik. Eine politisch-ökonomische Darstellung der gegenwärtigen Zustände in 4 Bänden. Verfasst von

Božidar Nikaschinovitsch. I. Band: Berliner Kongress 1878 und die Agrarfrage. Berlin: Thormann & Goetsch, 1901. Size 10 × 7, pp. viii. and 172.

This work, of which the first volume only has yet appeared, is intended to present a picture of the development of Bosnia and Herzegovina since their occupation by Austria in 1878.

Austria—Dalmatia. *B.S.G. Italiana* **2** (1901): 712–723. **Dainelli.**

Il Monte Promina in Dalmazia. Nota del socio dott. Giotto Dainelli.

Austria—Earthquakes. *Sitzb. A.W. Wien* **109** (*Abth. I.*) (1900): 151–314. **Mojsisovics.**

Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. XVIII. Allgemeiner Bericht und Chronik der im Jahre 1899 innerhalb des Beobachtungsgebietes erfolgten Erdbeben, zusammengestellt von Dr. Edmund v. Mojsisovics. *With Maps.*

Austria-Hungary. **Schoeller.**

Trade of Austria-Hungary for the year 1900. Foreign Office, Annual No. 2664, 1901. Size 9½ × 6, pp. 28. *Price* 2*d.*

Austria-Hungary—Census. *G.Z.* **7** (1901): 287–290. **Rebhann.**

Das Wachstum der Bevölkerung in Österreich-Ungarn. Von Prof. Dr. Andreas Rebhann.

Belgium. *B.S.R. Belge G.* **25** (1901): 149–176. **Rahir.**

Les curiosités de la commune de Furfooz. Par Edmond Rahir. *With Plan and Illustrations.*

Belgium. **Scudamore**

Belgium and the Belgians. By Cyril Scudamore. Edinburgh and London: W. Blackwood & Sons, 1901. Size 8 × 5¼, pp. xii. and 362. *Map and Illustrations. Price* 6*s. Presented by the Publishers.*

The object of this book is stated to be "not that of a guide-book, but rather to convey that information respecting Belgium and its people which we look for in vain in the excellent topographical works of Baedeker, Murray," etc. It contains useful chapters on religion, education, politics, the military system, etc., as well as that more purely descriptive.

Denmark—Census. *G.Z.* **7** (1901): 402–408. **Neukirch.**

Vorläufige Ergebnisse der allgemeinen dänischen Volkszählung vom 1 Februar, 1901 (eigentliches Dänemark). Von Dr. K. Neukirch.

English Channel. ———

Supplement, 1900, relating to the Channel Pilot. Part ii. Coast of France and the Channel Islands, 1897. (Corrected to September, 1900.) London: J. D. Potter, 1900. Size 10 × 6, pp. 80. *Price* 6*d. Presented by the Hydrographer, Admiralty.*

Europe—Geological History. *Globus* **79** (1901): 264–267. **Nehring.**

Fossile Kamele in Rumänien und die pleistocäne Steppenzeit Mitteleuropas. Von Prof. Dr. A. Nehring. *With Illustrations.*

Europe—Historical. *Rev. Historique* **76** (1901): 297–328. **Bourilly.**

L'ambassade de la Forest et de Marillac à Constantinople, 1535–1538. Par V. L. Bourrilly.

On an embassy sent by Francis I. of France to the Sultan with a view to securing a counterpoise to the power of the Emperor Charles V.

Faroe Islands. *Deutsche Rundschau G.* **23** (1901): 437–445. **Schoener.**

Die Faröer. Von G. Schoener. *With Map.*

Based upon a work lately published at Copenhagen.

France. *B.S.G. Marseille* **25** (1901): 7–19 **Clerc.**

Le bassin de Marseille, géographie et géologie. Par M. Michel Clerc.

France. *La G., B.S.G. Paris* **3** (1901): 449–460. **Lallemand.**

La réfection du Cadastre et la carte de France. Par Ch. Lallemand.

The writer describes the movement lately set on foot for the re-execution of the cadastral survey of France, and the experimental operations carried out under his direction in the commune of Neuilly-Plaisance near Paris.

Greece—Cyclades. **Cottrell.**

Trade of the Cyclades for the year 1900. Foreign Office, Annual No. 2599, 1901. Size 10 × 6, pp. 18. *Price* 1½*d.*

Iceland. *J. Manchester G.S.* **16** (1900): 229–243. **Newby.**

Iceland and the Icelanders. By J. R. Newby. III. *With Illustrations.*

Mediterranean—Cyprus. *Scottish G. Mag.* **17** (1901): 292–299. ——

Cyprus of To-day.

From an article by Dr. Maas in the *Geographische Zeitschrift.*

Norway—Christiania. **Amnéus.**

La ville de Kristiania, son Commerce, sa Navigation, et son Industrie. Résumé historique. . . . Par G. Amnéus. Kristiania, 1900. Size 9 × 6, pp. iv. and 180. *Illustrations.*

Norway—Lakes. **Huitfeldt-Kaas.**

Vidensk. Skrifter. I.—*Math.-naturv. Klasse* (1900), (No. 2): pp. 8.

Die limnetischen Peridineen in norwegischen Binnenseen. Von H. Huitfeldt-Kaas. *With Plate.*

Norway—Winds. **Mohn.**

Vidensk. Skrifter. I.—*Math.-naturv. Klasse* (1900), (No. 1): pp. 44.

Klima-Tabeller for Norge. XIII. Nedbør-Vindroser. Af H. Mohn.

Gives the results of twenty years' observations at seventy-seven stations in Norway.

Russia—Finland. **Mechelin and Others.**

Exposition Universelle de 1900. Notices sur la Finlande. Helsingfors, 1900. Size 9½ × 6. *Maps and Illustrations. Presented by J. Westlake, Esq.*

A collection of papers by various writers on the geography, government, social, intellectual, and material culture of Finland.

Russia—Survey. *M. Militär-G.I.* **20** (1900): 158–170. **Bielawski and Hartenthurn.**

Die topographischen Arbeiten im westrussischen Grenzgebiete. Von Josef Bielawski und Vincenz Haardt von Hartenthurn. *With Maps.*

Russia—Ural Mountains. *B. American G.S.* **33** (1901): 103–111. **Purington.**

Topographic Notes on the Ural Mountains. By Chester W. Purington. *With Sketch-maps.*

The writer lays stress on the great age of the Urals as a mountain range, and on the uniformity of conditions which have prevailed over a large area.

Servia. *B.S.G. Com. Bordeaux* **27** (1901): 153–159. **Delarue.**

La Serbie et les relations franco-serbes. Par Ch. Delarue.

United Kingdom—Birmingham Waterworks. **Webber.**

How the Welsh Water will come to Birmingham. By W. H. Y. Webber. (From the *Pall Mall Magazine*, June, 1901, pp. 181–191.) Size 9½ × 6½. *Illustrations.*

United Kingdom—Census. *J.R. Statistical S.* **64** (1901): 307–314. ——

First Results of the Census, 1901.

United Kingdom—Coal. **Geikie.**

How long will our Coal last? By James Geikie, F.R.S. (From the *Pall Mall Magazine*, July, 1901, pp. 390–398.)

Prof. Geikie dissents from the opinion of Prof. Hull that the question of the duration of our coal-supply is to this generation a matter only of academical interest.

United Kingdom—England and Wales—Census. ——

Census of England and Wales, 1901. Preliminary Report, and Tables of the Population and Houses enumerated in England and Wales, and in the Islands in the British Seas, on April 1, 1901. London: Eyre & Spottiswoode, 1901. Size 13 × 8½, pp. xx. and 158. *Price* 1*s.* 5½*d.*

United Kingdom—Fisheries. *Quarterly Rev.* **194** (1901): 83–102. ——

The Decay of our Sea Fisheries.

United Kingdom—Ireland—Census. ——

Census of Ireland for the year 1901. Preliminary Report, with Abstract of the Enumerators' Summaries. Dublin: E. Ponsonby, 1901. Size 13 × 8½, pp. 22. *Price* 2½*d.*

United Kingdom—Ordnance Survey. ———

Catalogue of the Maps and Plans and other Publications of the Ordnance Survey of England and Wales and the Isle of Man to January 1, 1901. London, 1901. Size 9½ × 6, pp. 810. *Index-maps. Price* 1*s.* 6*d.*

United Kingdom—Surrey. **Jerrold.**

Surrey. By Walter Jerrold. With special articles on the Bird-Life, Flowers, Entomology, Geology, Cycling, etc., of the County. London: J. M. Dent & Co., 1901. Size 7 × 4½, pp. xiv. and 316. *Maps and Illustrations. Price* 4*s.* 6*d. net. Presented by the Publishers.*

A tastefully got up guide to the scenery and other attractions of Surrey, which should prove useful to the increasing number of Londoners and others who seek their recreation within its borders.

United Kingdom—Yorkshire. *J. Manchester G.S.* **16** (1900): 244–257. **Gleave.**

The Yorkshire Dales: Wharfedale (Rievaulx Abbey) and Ryedale. By J. J. Gleave. *With Illustrations.*

ASIA.

Asia. *National G. Mag.* **12** (1901): 281–290. **McGee.**

Asia, the Cradle of Humanity. By WJ McGee.

Asia—Exploration. *La G., B.S.G. Paris* **4** (1901): 21–28. **Deniker.**

Récentes explorations russes en Asie. Par J. Deniker.

Asia—Exploration. *Deutsche Rundschau G.* **23** (1901): 446–463. **Jüttner.**

Fortschritte der geographischen Forschungen und Reisen im Jahre 1900. I. Asien. Von Dr. J. M. Jüttner.

Central Asia. *B. Comité l'Asie Française* **1** (1901): 99–105. **Saint-Yves.**

L'état actuel des rapports anglo-russes dans l'Asie centrale. Par G. Saint Yves. *With Maps.*

Ceylon—Veddahs. **Hiller and Furness.**

B. Free Museum Sci. and Art, University Pennsylvania **3** (1901): 69–87.

Notes of a Trip to the Veddahs of Ceylon. By Dr. H. M. Hiller and Dr. W. H. Furness. *With Illustrations.*

China. **Cordier.**

Histoire des Relations de la Chine avec les Puissances Occidentales 1860-1900. L'Empereur T'Oung Tché (1861–1875). Par Henri Cordier. Paris: F. Alcan, 1901. Size 9 × 6, pp. 570.

This accurate account of the relations between China and the European Powers during the past thirty years is likely to prove of much value at the present time.

China. *J. Franklin I.* **152** (1901): 141–152. **Garrison.**

Some Effects of Deforestation in China. By F. Lynwood Garrison. *With Map.*

The writer is one of those who still hold to the belief in the effect of deforestation on rainfall. "If any," he says, "doubts that drought, flood, and famine follow deforestation as surely as night succeeds day, let him visit China. . . ."

China. *B.S.G. Marseille* **25** (1901): 20–40. **Monod.**

En Chine. Par M. H. G. Monod.

Account of a journey in Yunnan, Kweichau, and part of Sechuan.

China—Minerals. *B.S.G. de l'Est* **21** (1901): 543–550. **Leclère.**

Les ressources minérales des provinces chinoises voisines du Tonkin. Par A. Leclère.

China—Newchwang. **Fulford.**

Trade of Newchwang for the year 1900. Foreign Office, Annual No. 2646. 1901. Size 9½ × 6, pp. 8. *Price* ½*d.*

China—Yang-tse-Kiang. *Globus* **80** (1901): 55–60. ———

Der Yang-tse-kiang, die deutschen Interessen und die Bedeutung des Stromes für die Erschliessung Chinas. *With Illustrations.*

China—Yunnan. *B. Comité l'Asie Française* **1** (1901): 141–158. ———

Le chemin de fer du Yunnan. Par R. C. *With Map.*

The project for a railway from Tong-king to the capital of Yunnan was ratified by the French chambers in June and July last.

Chinese Empire—Tangut. **Parker.**
Imp. and Asiatic Quarterly Rev. **11** (1901): 363-378; **12** (1901): 156-179.
Marco Polo's Tangut. By C. H. Parker.

Chinese Turkestan. **Stein.**
Archæological Discoveries in the neighbourhood of the Niya River. By M. A. Stein. (From the *Journal of the Royal Asiatic Society*, July, 1901.) Hertford: 1901. Size 8¼ × 5¼, pp. 4. *Presented by the Author.*
Over an area once irrigated from the Niya river the author found ruins of old dwelling-houses, Buddhist monasteries, etc., which yielded an abundant supply of epigraphical and other relics.

Dutch East Indies. **Meyjes.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 543-583.
De Astronomische Plaatsbepalingen ten dienste der Hydrographie in Ned. Indië (1857-'94). Door R. Posthumus Meyjes. *With Maps.*
A sketch of the various operations for the astronomical determination of position in the Dutch East Indies, chiefly since 1890.

India and Ceylon—Tea. *Die Natur* **50** (1901): 253-256. **Schulte.**
Die Kultur von Thee in Britisch-Indien und Ceylon. Nach Dr. A. Schulte.

Indian Ocean—Christmas Island. **Clayton.**
Christmas Island. Report for 1900. Colonial Reports, Annual No. 319, 1901. Size 9½ × 6, pp. 20. *Price* 1½*d.*

Indian Ocean—Maldive Islands. **Gardiner.**
The Natives of the Maldives. By J. Stanley Gardiner. [Extracted from the *Proceedings of the Cambridge Philosophical Society*, vol. xi. pt. i.] Size 9 × 6, pp. 17-20.

Indian Ocean—Minikoi. **Gardiner.**
The Atoll of Minikoi. By J. Stanley Gardiner. [Extracted from the *Proceedings of the Cambridge Philosophical Society*, vol. xi. pt. i.] Size 9 × 6, pp. 22-26. *Map.*
A note on these two papers appeared in the *Journal* for May (p. 526).

Indian Ocean—Seychelles. *B.G. Hist. et Descriptive* (1900): 268-273. **Saint-Yves**
Les îles Seychelles en 1791. Par M. G. Saint-Yves.

Malay Archipelago—Java. **Oudemans.**
Die Triangulation von Java ausgeführt vom Personal des geographischen Dienstes in Niederländisch Ost-Indien. Sechste und letzte Abtheilung. Die Höhen-, Breiten- und Azimuthbestimmungen, die Lothabweichungen im Sinne des Meridians und des Parallels, nebst einem Anhange: Geschichtliches über die terrestrische Refraction, im Auftrag des Ministeriums von Kolonien und unter Mitwirkung von M. L. J. van Asperen bearbeitet von Dr. J. A. C. Oudemans. Haag, M. Nijhoff, 1900. Size 14 × 10½, pp. iv., 154, and 88. *Maps and Diagrams. Presented by the Editor.*

Persia. *J.R. Statistical S.* **64** (1901): 265-291. **Rabino.**
An Economist's Notes on Persia. By Joseph Rabino.

Philippine Islands. *B. American G.S.* **33** (1901): 112-123. **Becker.**
Conditions requisite to our Success in the Philippine Islands. By G. F. Becker.

Russia—Kirghiz Steppe. *Petermanns M.* **47** (1901): 106-114. **Stahl.**
Beobachtungen in den Kirgisensteppen. Von A. F. Stahl. *With Map.*

Russia—Tiflis Observations. ———
Beobachtungen des Tifliser Physikalischen Observatoriums im Jahre 1897. Tiflis, 1900. Size 12½ × 9½, pp. lvi. and 198.

Tibet. *Miss. Catholiques* **33** (1901): 259-264, 269-273, 279-281, 292-295. **Monbeig.**
Voyage en Pays Thibétains. Par M. Th. Monbeig. *With Illustrations.*
On a journey through the Tibetan districts on the western borders of China.

Turkey. *Z. Ges. Erdk. Berlin* **36** (1901): 69-99. **Oppenheim.**
Bericht über eine im Jahr 1899 ausgeführte Forschungsreise in der Asiatischen Türkei. Von Dr. Max Frhr. v. Oppenheim. *With Map and Plates. Also separate copy, presented by the Author.*

Turkey. *Verh. Ges. Erdk. Berlin* **28** (1901): 294–295. **Rohrbach.**

Vergangene und zukünftige Kultur am Euphrat und Tigris. Studien in Mesopotamien und Babylonien im Winter 1900–1901. Von Dr. Paul Rohrbach.

Turkey—Asia Minor. *Z. Ges. Erdk. Berlin* **36** (1901): 100–114. **Brennecke.**

Ergebnisse der Höhenmessungen Prof. A. Philippson's in der Umgebung von Pergamon. Von W. Brennecke.

Gives the results of altitude-determinations by aneroid during a journey in September and October of last year.

Turkey—Asia Minor. *Petermanns M.* **47** (1901): 132–137. **Schaffer.**

Zur Geotektonik des südöstlichen Anatolien. Studien auf Reisen im Frühjahr und Herbst 1900. Von Dr. Franz Schaffer. *With Map.*

This is noticed elsewhere (*ante*, p. 440).

Western Asia. *Scottish G. Mag.* **17** (1901): 281–292. **Medley**

India to England *viâ* Central Asia and Siberia. By Major E. J. Medley.

The journey was undertaken from Gilgit in October of last year, and led *viâ* Kashgar and Vernye to Semipalatinsk.

AFRICA.

Africa. *La G., B.S.G. Paris* **4** (1901): 97–103. ——

Récentes explorations françaises en Afrique. 1° Exploration de M. de Mathuisieulx en Tripolitane. 2° Lettre de M. Fondère sur l'exploration de la Bali, par MM. Frédon et Cadenat. 3° Nouvelle exploration de M. G. Grandidier à Madagascar. 4° La Mission Lesieur au Congo français.

The second and fourth of these papers are referred to at p. 535, *ante*.

Basutoland. *Scottish G. Mag.* **17** (1901): 347–362. **Lagden.**

Basutoland and the Basutos. By Sir Godfrey Lagden, K.C.M.G.

British Central Africa. *Scottish G. Mag.* **17** (1901): 363–377. **Capenny.**

Railway Schemes in Relation to British Central Africa. By S. H. F. Capenny.

British East Africa. **Hinde.**

The Last of the Masai. By Sidney Langford Hinde and Hildegarde Hinde. London: William Heinemann, 1901. Size 10 × 7½, pp. 200. *Illustrations. Presented by the Authors.*

This will receive special notice.

British East Africa—Uganda Railway. **[Gracey.]**

Africa. No. 6 (1901). Correspondence respecting the Uganda Railway. London: Eyre & Spottiswoode, 1901. Size 13 × 8½, pp. 68. *Price* 7*d.*

See note in September *Journal* (p. 310).

British South Africa. ——

The British South Africa Company. Reports on the Administration of Rhodesia, 1898–1900. Size 10½ × 8½. *Maps. Presented by the British South Africa Co.*

This is noticed in the Monthly Record (p. 533).

British South Africa—Matabeleland. *J. Anthrop. I.* **31** (1901): 21–28. **White.**

On the Ruins of Dhlo-Dhlo, in Rhodesia. By Franklin White. *With Plates.*

These ruins, which lie some 50 miles north-east of Bulawayo, were first examined by Dr. H. Schlichter, who spoke of them as the "Mombo" ruins, from the name of the district. Mr. White has lately made a plan of the chief of them, and taken photographs showing the mode of construction and ornamentation of the walls.

Central Africa. *B.S.G. Marseille* **25** (1901): 47–53. **Roulet.**

Mission du Congo au Nil, conférence du Commandant Roulet.

The author commanded an expedition for the support of Marchand in 1897.

Congo State. *Imp. and Asiatic Quarterly Rev.* **12** (1901): 86–100. **Bourne.**

The Congo Free State. By H. R. Fox Bourne.

Congo State. *Mouvement G.* **18** (1901): 382–385. **Thonnar.**

Les populations errantes de l'État du Congo. Par Albert Thonnar.

An extract from a larger work lately published at Brussels.

East Africa—Pemba. **O'Sullivan-Beare.**

Report on the Island of Pemba for the year 1900. Foreign Office, Annual No. 2653, 1901. Size 9½ × 6, pp. 26. *Plate.* *Price* 3½*d.*

The year 1900 was unfavourable owing to the scantiness of the clove-crop and the low prices ruling. Statistics are given as to the manumission of slaves, the greater number of whom have settled on "shambas" upon conditions entered into with the Arab cultivators.

Egypt. **Rumbold.**

British Trade with Egypt during the years 1895–1900. Foreign Office, Miscellaneous, No. 557, 1901. Size 9½ × 6, pp. 32. *Price* 2*d.*

Eritrea. *B.S.G. Italiana* **2** (1901): 750–753. ——

La Sfera d'influenza italiana in Africa nella 'Spezial Karte von Afrika' di Hermann Habenicht. *Map.*

The map shows the frontiers of Eritrea as fixed by the latest agreements.

Fernando Po. *Kolon. Z.* **2** (1901): 191–194. ——

Fernando Poo.

A summary of our present knowledge of the island.

Madagascar. *Rev. G.* **49** (1901): 83–85. ——

Une reconnaissance au plateau de l'Androy, et au Faux-Cap au sud-est de Madagascar (juin-juillet 1900). Par S. L. *With Maps.*

Madagascar—Betsileo. *Antananarivo Annual* **6** (1900): 481–485. **Johnson.**

Betsileo, Past and Present. A Twenty Years' Review. By H. T. Johnson.

Madagascar—Imerina. *Antananarivo Annual* **6** (1900): 451–475. **Lord.**

The Early History of Imerina based upon a Native Account. By T. Lord.

Madagascar—Sakalava. *Antananarivo Annual* **6** (1900): 408–437. ——

Observations on the Sakalava.

Nigeria. *Monthly Rev.* **3** (1901): 67–78. **Bindloss.**

Nigeria and its Trade. By Harold Bindloss.

North-East Africa. **Crosby**

Notes on a Journey from Zeila to Khartum. By Oscar T. Crosby. (From the *Geographical Journal* for July, 1901.) Size 10 × 6½, pp. 16. *Map and Illustrations.*

North-East Africa. **Sacchi, d'Ossat, and Millosevich.**

Seconda Spedizione Bòttego. Studio geologico sul materiale raccolto da M. Sacchi, G. de Angelis d'Ossat e F. Millosevich. Roma, 1900. Size 10 × 7, pp. x. and 212. *Map and Plates.* *Price* 5*s. net.*

A valuable contribution to our knowledge of the geology of Central Africa, supplementing the results previously published in the work of Lieuts. Vannutelli and Citerni.

North-West Africa. *Rev. G.* **48** (1901): 451–462; **49** (1901): 1–12. **Cuny.**

La conquête du Touat et le Maroc. Par Général L. Cuny. *With Illustrations.*

Upper Nile. *Quarterly Rev.* **194** (1901): 1–32. ——

Negro Nileland and Uganda. *With Map.*

A summary of recent work on the upper Nile.

NORTH AMERICA.

Alaska—Altitudes. *B. United States Geol. Surv.* No. 169 (1900): pp. 14. **Gannett.**

Altitudes in Alaska. Compiled by Henry Gannett.

The height of Mount McKinley is given as 20,464 feet, as determined by Mr. Muldrow (see below).

Alaska—Mount McKinley. *National G. Mag.* **12** (1901): 312–313. **Muldrow.**

Mount McKinley. By Robert Muldrow. *With Map.*

See note in the present number of the *Journal* (p. 536).

Bermuda. **Smith.**

Bermuda. Report for 1900. Colonial Reports, Annual, No. 322, 1901. Size 9½ × 6, pp. 20. *Price* 1½*d.*

Canada—British Columbia.

Annual Report of the Minister of Mines for the year ending 31st December, 1900. Being an account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C., 1901. Size 10 × 7, pp. 703-1027. *Maps and Illustrations.*

This report records a rapid growth within recent years of the mining industry of British Columbia. A general map shows the mining districts of the province, the northern portion of which is shown separately on the large scale of 6 miles to the inch.

Canada—Nova Scotia. **Daly.**

The Physiography of Acadia. By Reginald A. Daly. Bulletin Museum Comparative Zoology at Harvard College, vol. xxxviii. Geological Series, vol. v. No. 3. Cambridge, Mass., 1901. Size 9½ × 6, pp. 73-104. *Map and Plates. Presented by the Author.*

North America—Bibliography. **Weeks.**

B. United States Geol. Surv. No. 172 (1900): pp. 142.

Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the year 1899. By Fred Boughton Weeks.

North America—Historical. **Chesnel.**

Histoire de Cavelier de La Salle. Exploration et Conquête du Bassin du Mississipi. D'Après les Lettres de La Salle, les Relations présentées à Louis xiv. en son nom, les Relations de plusieurs de ses compagnons de voyage, les Actes officiels et autres Documents contemporains. Par P. Chesnel. Paris: J. Maisonneuve, 1901. Size 9½ × 5½, pp. 228.

Although the explorations of La Salle have been dealt with by Margry in his great collection of original documents, this seems to be the first full and yet popular account of the exploits of the great French explorer which has appeared in his own country. It may be placed on a level with Parkman's well-known work on the same subject.

United States. *B. United States Geol. Surv.* No. 174 (1900): pp. 78. **Baker.**

Survey of the North-Western Boundary of the United States, 1857-1861. By Marcus Baker. *With Index Map.*

A historical sketch of the establishment and survey of the boundary between the United States and Canada along the forty-ninth parallel.

United States. *B. United States Geol. Surv.* No. 171 (1900): pp. 142. **Gannett.**

Boundaries of the United States and of the Several States and Territories, with an outline of the History of all important changes of territory. (Second Edition.) By Henry Gannett. *With Maps and Diagrams.*

A revised edition, brought up to date, of a previous bulletin, published in 1885.

United States—Indiana—Caves. **Farrington.**

Observations on Indiana Caves. By Oliver Cummings Farrington, PH.D. (Field Columbian Museum. Publication 53. Geological Series. Vol. i. No. 8.) Chicago, 1901. Size 10 × 6½, pp. 247-266. *Illustrations. Presented by the Field Columbian Museum.*

United States—Iroquois. *Rev. G.* **49** (1901): 58-70. **Tricoche.**

Les derniere des Iroquois. Par George Nestler Tricoche. *With Map.*

United States—Kentucky. *J. School G.* **4** (1900): 361-370. **Temple.**

Louisville: a Study in Economic Geography. By Ellen C. Temple.

An instructive study of the working of geographical forces in a city typical of a large percentage of the cities of the United States.

United States—Maryland. **Shattuck.**

Johns Hopkins University Circulars **20** (1901): 69-75.

The Pleistocene Problem of the North Atlantic Coastal Plain. By George Burbank Shattuck.

On the recent geological history of the coast region of Maryland.

United States—Maryland.

Maryland Geological Survey. Eocene. Baltimore, 1901. Size 10½ × 7, pp. 332. *Map and Plates. Presented by the State Geologist, Maryland.*

This is the first volume of a contemplated series of reports dealing with the systematic geology and palæontology of Maryland.

United States—Meteorology.

U.S. Department of Agriculture. Weather Bureau. Report of the Chief of the Weather Bureau. 1898-99. 2 vols. Washington, 1900. Size 12 × 9, pp. (vol. i.) 248; (vol. ii.) 788. *Diagrams. Presented by the U.S. Department of Agriculture, Weather Bureau.*

United States—Montana. *American J. Sci.* **12** (1901): 1-17. **Weed and Pirsson.**

Geology of the Shonkin Sag and Palisade Butte Laccoliths in the Highwood Mountains of Montana. By W. H. Weed and L. V. Pirsson. *With Illustrations.*

United States—Observations.

Astronomical, Magnetic, and Meteorological Observations made during the years 1891 and 1892, at the United States Naval Observatory. Washington, 1899. Size 12 × 9, pp. lx. 56, 58; xxxii. 24, 64; lxii. and 288.

United States—Trade. **Hitchcock.**

Our Foreign Trade in Agricultural Products, 1891-1900. By Frank H. Hitchcock. (U.S. Department of Agriculture. Section of Foreign Markets. Bulletin No. 23.) Washington, 1900. Size 9½ × 6, pp. 62.

United States—Trade. *Fortnightly Rev.* **70** (1901): 61-75. **Taylor.**

Maritime Expansion of America. By Benjamin Taylor.

United States—Zinc Industry. **Erskine.**

Zinc Industry in the United States. Foreign Office, Miscellaneous, No. 550, 1901. Size 9½ × 6, pp. 8. *Price* ½*d.*

CENTRAL AND SOUTH AMERICA.

Antigua. *Monthly Weather Rev.* **29** (1901): 165-167. **Alexander.**

The climatology of Antigua, W.I. By Wm. H. Alexander.

Antigua. *Monthly Weather Rev.* **29** (1901): 168-173. **Kimball.**

The seasonal variations in the climate of Antigua, W.I. By H. H. Kimball.

Argentine Republic. **Betbeder.**

Memoria del Ministerio de Marina correspondiente al ejercicio 1900-1901. Presentada al Honorable Congreso de la Nacion por el Ministro de Marina, Capitán de Navío Onofre Betbeder. Buenos Aires, 1901. Size 10½ × 7, pp. 52.

Argentine Republic. *B.S.G. Italiana* **2** (1901): 723-744, 798-814. **Cipolletti.**

Repubblica Argentina; Territori del Rio Negro e del Rio Colorado; descrizione, studi idrologici e proposte di colonizzazione, del socio ing. Cesare Cipolletti.

Argentine Republic. **Martinez.**

Manual del Viajero. Baedeker de la República Argentina. Por Alberto B. Martínez. Buenos Aires, 1900. Size 6½ × 4½, pp. xiv. and 370. *Map, Plans, and Illustrations.*

This guide to the Argentine Republic is produced on the model of Baedeker's guides. It contains an introduction giving a general summary of the history, geography, industries, etc., of the country; an account of the city of Buenos Aires, its public institutions, etc.; and a detailed account of the principal routes from the capital to the outer borders of the republic. The arrangement shows here and there some confusion, which will no doubt be rectified in a new edition.

Bolivia.

Anexos a la Memoria del Ministro de relaciones exteriores y Culto presentada al Congreso ordinario de 1900. La Paz, 1901. Size 11½ × 7½, pp. 342.

A collection of documents bearing on the relations of Bolivia with other States.

Brazil. **Rhind.**

Financial and Economic Situation in Brazil. Foreign Office, Miscellaneous, No. 558, 1901. Size 9½ × 6, pp. 10. *Price* 1*d.*

Chile. **Fagalde.**

Magallanes el pais del porvenir. Por Alberto Fagalde. Tomo Primero. Valparaiso, 1901. Size 10½ × 7, pp. vi. and 438. *Map, Plan, and Illustrations.*

The first part of this work gives a useful summary of the history of discovery in Southern Patagonia; the second an account of the recent development of the country, of the capabilities of which the author holds sanguine views.

Chile—Hydrography.

Anuario hidrografico de la Marina de Chile. Tomo 22. Valparaiso, 1900. Size 10½ × 7, pp. 38 and 516. *Charts and Diagrams. Presented by the Chilean Admiralty.*

Contains several papers on recent surveys of the Chilian coasts.

Cuba. *American J. Sci.* **12** (1901): 33–41. **Peckham.**

Bituminous Deposits situated at the South and East of Cárdenas, Cuba. By H. E. Peckham. *With Sketch-maps.*

Haiti. *Petermanns M.* **47** (1901): 121–127. **Gentil-Tippenhauer.**

Beiträge zur Geologie Haïtis. Von L. Gentil-Tippenhauer. IV. Die Erzfundstätten von Terre-Neuve und Gonaives. *With Map.*

South America. *M.V. Erdk. Leipzig* (1900): 27–115. **Arldt.**

Ueber den Parallelismus der Küsten von Südamerika. Von Dr. Theodor Arldt. *Map.*

A note on this paper appears in the Monthly Record.

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Grey.**

Australasia Old and New. By J. Grattan Grey. London: Hodder & Stoughton, 1901. Size 8 × 5½, pp. xvi. and 396. *Portrait. Price* 7*s.* 6*d. Presented by the Publishers.*

The author has written this book with a view to combating the ignorance on Australasian affairs, which he considers to prevail in this country on the part of the general public. In it he traces the history of the colonies from their first beginnings down to the opening of the present century, and endeavours to present a clear picture of their present condition and prospects. His views, which are expressed without reserve, will doubtless not meet with approval in some quarters, but the book should be of use in directing attention to the many important problems awaiting solution in the new commonwealth and adjacent countries.

Australia and Pacific. *B. Comité l'Asie Française* **1** (1901): 134–141. **Leroy-Beaulieu.**

L'Australie et le Pacifique: Les forces, les faiblesses et les prétentions de la fédération australienne. Par Pierre Leroy-Beaulieu.

Australia and Pacific. **Schanz.**

Australien und die Südsee an der Jahrhundertwende. Kolonialstudien von Moritz Schanz. Berlin: W. Süsserott, 1901. (London: Williams & Norgate.) Size 10 × 6½, pp. 326. *Illustrations. Presented by the Publisher.*

The author places before the German public a clear account of the Australasian colonies, their history, resources, present condition, scenery, etc., with chapters on Fiji, Tonga, and Samoa. The work will be useful, outside Germany, as a compendium of information on the countries dealt with, the collection of which might otherwise be a work of some trouble. It is excellently illustrated with views of scenery, etc.

Australia and Tasmania—Ornithology. **North.**

Australian Museum, Sydney. Special Catalogue No. 1. Nests and Eggs of Birds found breeding in Australia and Tasmania. By Alfred J. North. Second Edition of Catalogue No. xii., entirely re-written, with additions. Part i. Sydney, 1901. Size 12½ × 10, pp. 36. *Illustrations. Presented by the Australian Museum, Sydney.*

The first instalment of an important work on Australian Ornithology. It is produced in excellent style, and is not by any means a mere catalogue, but contains much information as to the birds and their habits, as well as their nests and eggs.

POLAR REGIONS.

Antarctic. **Bernacchi.**

To the South Polar Regions. Expedition of 1898–1900. By Louis Bernacchi. London: Hurst & Blackett, 1901. Size 9 × 6, pp. xvi. and 348. *Charts and Illustrations. Price* 12*s. net. Presented by the Publishers.*

This will be specially noticed.

Antarctic. *B.S.G. Italiana* **2** (1901): 653–658. **Faustini.**

La "Groenlandia del Sud." Nota del socio A. Faustini.

Discusses the question of the "New South Greenland" reported by the American whaling captains Johnson and Morell. The writer thinks it quite possible that a

higher latitude was reached by these than by their successors in the region in question (48° 10′ W.).

Antarctic—Belgian Expedition. **Gribaudi.**
Riv. G. Italiana **8** (1901): 345–355, 449–460.
Il primo sverno nelle regioni polari antartiche. Alcuni risultati scientifici della spedizione antartica belga (A. De Gerlache) 1897–1899. Nota del Prof. Pietro Gribaudi.

Arctic—Auroras. *Monthly Weather Rev.* **29** (1901): 107–115. **Baldwin.**
Auroral observations on the Second Wellmann Expedition made in the neighbourhood of Franz Josef Land. By E. B. Baldwin. *Also separate copy, presented by the Author.*

Arctic—Jan Mayen. *Bihang Svensk. A. Handlingar* **26** (1900), (No. 13): 16. **Dusén.**
Beiträge zur Flora der insel Jan Mayen. Von P. Dusén. *With Plate.*

Greenland. **Nathorst.**
Bidrag till nordöstra Grönlands geologi. Af A. G. Nathorst. (*Geol. Fören. Förhandl.*, No. 207, Bd. 23, Häft 4.) Size 8½ × 5½, pp. 275–306. *Map and Plates. Presented by the Author.*

Greenland. *P.A. Nat. Sci. Philadelphia* **53** (1901): 144–168. **Ortmann.**
Crustacea and Pycnogonida collected during the Princeton Expedition to North Greenland. By Dr. A. E. Ortmann.

Greenland. *P.A. Nat. Sci. Philadelphia* **53** (1901): 169–181. **Rankin.**
Echinoderms collected off the West Coast of Greenland by the Princeton Arctic Expedition of 1899. By Walter M. Rankin.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Denudation. *Naturw. Wochenschrift* **16** (1901): 369–373. **Passarge.**
Ueber Winderosion. Von Dr. S. Passarge. *With Illustrations.*

Geomorphology. *Ann. G.* **10** (1901): 289–294. **Martonne.**
Fjords, cirques, vallées alpines et lacs subalpins. Par M. Emm. de Martonne.

Gravity. *Sitzb. A.W. Wien* **108** (Abth. IIa.) (1899): 697–766. **Sterneck.**
Untersuchungen über den Zusammenhang der Schwere unter der Erdoberfläche mit der Temperatur. Von Oberst Robert v. Sterneck.

Meteorology. *Q.J. Geolog. S.* **57** (1901): 405–478. **Harmer.**
The Influence of the Winds upon Climate during the Pleistocene Epoch: a Palæometeorological Explanation of some Geological Problems. By F. W. Harmer. *With Charts.*
Mr. Harmer's suggestions were first brought forward at the Bradford meeting of the British Association (cf. *Journal*, vol. xvi. p. 446).

Oceanography. **Monaco.**
Notes de Géographie Biologique Marine. Communication faite au VII^ème^ Congrès International de Géographie à Berlin en 1899. Par S. A. S. Albert I., Prince de Monaco. (Sonderabdruck aus den Verhandlungen des VII. Internationalen Geographen-Kongresses in Berlin, 1899.) Berlin, 1900. Size 10 × 6½, pp. 312–322.

Oceanography—Baltic. *Ann. Hydrographie* **29** (1901): 226–231. **Knudsen.**
Der baltische Strom und der Salzgehalt im Kattegat und im westlichen Theile der Ostsee. Von Martin Knudsen.

Oceanography—Fauna. **Monaco.**
Résultats des Campagnes scientifiques accomplies sur son yacht par Albert 1^er^ Prince Souverain de Monaco publiés sous sa direction avec le concours de M. Jules Richard. Fasc. xvii. Céphalopodes provenant des campagnes de la *Princesse-Alice* (1891–1897). Par Louis Joubin (pp. 136). Fasc. xviii. Hydraires provenant des campagnes de *l'Hirondelle* (1886–1888). Par Camille Pictet et Maurice Bedot (pp. 58). Imprimerie de Monaco, 1900. Size 14 × 11. *Plates. Presented by H.S.H. the Prince of Monaco.*

Oceanography—Methods. *B.S.G. Com. Bordeaux* **27** (1901): 173–178. **Thoulet.**
Sur le mode de récolte des échantillons du sol sous-marin. Par J. Thoulet.

Volcanoes. *M.V. Erdk. Leipzig* (1900): 1–26. **Wägler.**
Die Geographische Verbreitung der Vulkane. Bemerkungen zu den Karten über die geographische Verbreitung des Vulcanismus. Von Dr. C. W. Wägler. *Maps.*
A note on this paper appears elsewhere (p. 540).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonisation. *Rev. G.* **48** (1901): 241–253, 433–450; **49** (1901): 97–123. **Brugière.**
L'expansion européenne pendant le XIX^e^ siècle. Par F. Brugière.

Colonisation. *Kolon. Z.* **2** (1901): 223–225. **Meinecke.**
Kolonisatorische Aufgaben. I. Hebung der Produktion der Eingeborenen. Von G. Meinecke.

Commercial Geography. *Nautical Mag.* **70** (1901): 442–449. **Turner.**
The World's Great Ports. By W. Turner.
The writer calls attention to the enormous strides made within recent years by the port of Hamburg, which in 1900 for the first time stood first of all the ports of the world in the over-sea trade.

Commercial Geography—Coffee. *La G., B.S.G. Paris* **3** (1901): 471–488. **Lecomte.**
La Culture du café dans le monde. Par H. Lecomte. *With Maps.*

Man and the Ocean. *G.Z.* **7** (1901): 241–250. **Kirchhoff.**
Das Meer im Leben der Völker. Vortrag, gehalten am Institut für Meereskunde zu Berlin. Von Alfred Kirchhoff.

Mountain Passes. *B. American G.S.* **33** (1901): 124–137, 191–203. **Semple.**
Mountain Passes. A Study in Anthropogeography. By Ellen C. Semple.
See note in *Journal* for September (p. 316).

National development. *Rev. G. Italiana* **8** (1901): 432–448. **Biasutti.**
La Base economica delle conquiste geografiche. Nota di Renato Biasutti.
On the influence of economic factors on the expansion of peoples.

GENERAL.

Bibliography. **Raveneau.**
Dixième Bibliographie Géographique Annuelle, 1900, publiée sous la direction de Louis Raveneau. Annales de Géographie, No. 53, 10^e^ Année, 15 Septembre 1901. Paris: Armand Colin. Size 10 × 6½, pp. 320.
This latest volume of the useful geographical bibliography contains the titles of 908 works or papers, most of which are analyzed at greater or less length.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**
ORDNANCE SURVEY OF ENGLAND AND WALES: Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 31, 1901.

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With hills in brown or black: 131, 137, 148, 169, 193, 195, 211, 229 (engraved), 1*s. each.* Printed in colours: 10, 20, 23, 175, 181, 182, 184, 188, 1*s. each.* Pembroke, 228, 245 (combined), 1*s.* 6*d.*
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7 N.W., N.E., 8 N.W., N.E., S.W., S.E., 11 S.E., 12 S.W., S.E., 13 N.E., 14 N.W., 15 S.E., 16 N.E., 18 S.E., 19 S.E., 20 N.E., S.E., 21 N.W., S.W. **Monmouthshire**, 17 N.W., 37 S.E., **Northamptonshire** (1 N.E. and 2 N.W.). **Staffordshire**, 22 S.E., 23 N.W., N.E., S.E., 24 N.E., S.E., 25 N.W., S.E., 26 N.W., N.E., S.W., 31 S.W., 32 S.E. **Wiltshire**, 32 S.W., 38 S.E., 44 S.E., 45 S.W., 54 S.E., 57 N.E., S.E., 58 N.W., S.W., 69 S.E., 70 S.E. 1*s. each.*

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Cardiganshire, II. 3, 7. **Derbyshire**, LVII. 1; LIX. 3, 7, 8, 10, 11, 12, 15, 16; LX. 3, 8, 11, 13, 14, 15; LXI. 2, 5; LXII. 4, 8; LXIII. 1, 2, 3, 9. **Dorsetshire**, I. 10, 14, 15; II. 9; III. 4; IV. 2, 6, 15; VIII. 2, 4, 7, 8, 11, 12, 15, 16; IX. 4 (6 and 10), 7, 8, 9 (10 and 6), 11, 12, 13, 14, 15, 16; X. 1, 5, 6, 9, 10, 13; XIV. 3, 4; XV. 1, 2, 3, 4, 5, 6, 7, 8, 9; XVI. 1, 2, 5; LI. (2 and 3). **Huntingdonshire**, I. 12, 16; IV. 4; V. 1, 2, 8; VI. 9, 13, 14; IX. 7; X. 1, 5, 6, 7, 10, 13, 14; XIII. 4, 8, 16; XIV. 1, 2, 3, 5, 9, 10, 11, 13; XVII. 8, 12, 16; XVIII. 1, 3, 5, 6, 7, 10; XX. (2 and 1), 4, 6, 7, 8, 10, 11, 12; XXI. 1, 2, 7, 10, 11, 13, 16; XXII. 3, 5, 6, 7, 8, 9; XXV. 1, 2, 3, 4, 5, 7, 8, 9, 12, 16; XXVII. 4. **Monmouthshire**, VIII. 14; XI. 9; XIV. 5, 7, 8, 9, 11, 13, 15; XVIII. 10; XIX. 15; XX. 1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 14, 15; XXII. 12; XXIII. 3, 11, 12; XXV. 3; XXVII. 8; XXVIII. 9, 13, 14; XXIX. 5, 13, 16; XXXIII. 3, 7, 11; XXXIV. 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14. **Montgomeryshire**, X. 8, 12; XI. 6; XIII. 13; XIV. 8, 9, 10, 11, 12; XV. 9, 10, 11; XIX. 8, 9, 10, 11, 12, 13, 14, 15; XX. 9, 10, 11, 12, 13; XXI. 2, 3, 5, 6, 7, 10; XXVI. 1, 2, 3, 5, 6, 9, 10, 11; XXXII. 3. **Shropshire**, V. 12; VI. 5, 6, 7, 9, 10, 13; VII. 14, 15; VIII. 13, 14, 15, 16; IX. 13; XII. 12, 14, 15; XIII. 1, 5, 9, 13; XVIII. 8, 12; XIX. 2, 3, 4, 6, 8; XX. 1, 5, 13, 15; XXV. 8; XXVI. 3, 4, 6. **Staffordshire**, XXXVII. 7; XXXVIII. 10, 13; XL. 16; XLI. 1; XLVII. 3, 7, 10, 11, 15; LIII. 4, 8; LIV. 9. **Wiltshire**, LXIII. 10, 14; LXIV. 9; LXVI. 11, 15; LXVIII. 3, 4, 8, 12, 16; LXIX. 13; LXXIII. 5, 9, 13; (LXXIV. 1 and LXXIVA. 4); LXXIV. 5, 6, 8, 10, 11, 12, 14, 15; (LXXIVA. 4 and LXXIV. 1); LXXV. 2 (5 and 6); LXXVII. 6, 8, 10, 12, 14, 15, 16; LXXVIII. 5. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

Plan of Manchester and Salford. By J. Bartholomew. Scale 1 : 10,560 or 6 inches to 1 stat. mile. London: W. H. Smith & Sons, 1901. *Price* 2*s. Presented by Messrs. J. Bartholomew & Co.*

This is a new edition, with roads, etc., added to bring it up to date.

England and Wales. **Johnston.**

Cycling and Automobile Map of London and the North. Scale 1 : 190,080 or 3 stat. miles to an inch. London & Edinburgh: W. & A. K. Johnston. *Price* 1*s.* 6*d. each sheet. Presented by the Publishers.*

Another of W. & A. K. Johnston's cycling maps of districts round London, prepared from their "Three Miles to an Inch" map of England and Wales. It includes the country from Croydon on the south to about five miles beyond Huntingdon on the north, and from Maidenhead on the west to Chatham on the east. The principal roads are shown in red, and circles are drawn, with London as a centre, at intervals of three miles.

ASIA.

Asiatic Russia. **Russian Government.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1 : 1,168,031 or 18·4 stat. miles to an inch. Sheet 2, Astrakhan and Orenburg. Military Topographical Department, St. Petersburg. 1901.

According to the index, this map is now nearly completed, there being only two more sheets to be published. The sheet just issued embraces the region between Simbirsk on the north and the Caspian on the south, and between the Volga on the west and Ufa on the east.

China. **Quarter-Master General's Department, Simla.**

Preliminary Map of the China Field Force. Scale 1 : 126,720 or 2 stat. miles to an inch. Quarter-Master General's Department, Intelligence Branch, Simla. Zincographed at the Survey of India Offices, Calcutta, August, 1901. *Presented by the Assistant Quarter-Master General, Intelligence Branch, Simla.*

The area included in this map is approximately from 35 miles to the west of Pekin to the Gulf of Pe-chili, and from 40° 16′ N. lat. to Tientsin and Taku. It consists

altogether of seventeen sheets and an index, according to which it appears that it is the intention at some future date to extend the limits of the map. It is a rough zincograph in black and white, but contains a great deal of detailed information, which has been brought together from all available sources.

Formosa. **Japanese Government.**

Map of Formosa. Scale 1 : 400,000 or 6·3 miles to an inch. The Survey Department, Tokio. *Presented by the Director of Japanese Surveys, Tokio.*

Since Formosa was taken over by Japan, considerable progress has been made with the surveys and mapping of the island. In addition to the 1 : 200,000 map, there has now been published the map here mentioned, which is a reduction of the former on half the scale, in six sheets. The lettering is in native characters.

Indian Government Surveys. **Surveyor-General of India.**

India, 32 miles to an inch. Third edition, 1898 (additions and corrections to 1900). 6 sheets.—Railway map of India, 48 miles to an inch, 1901. 4 sheets.—Railway System of India, 50 miles to an inch, 1901.—India, 64 miles to an inch, 1901. 4 sheets.—Lower Provinces Revenue Survey, 1 mile to an inch. Sheet 7, District Purneah, Additions to 1897, 1900.—Bengal Survey, 1 mile to an inch; sheet 171, District Durbhunga, Seasons 1846–49, 1900; sheet 269 (first edition), Seasons 1861–67 and 1881–89, District Darjeeling, 1901; sheet 270 (first edition), District Darjeeling and Jalpaiguri, Seasons, 1858–59, 61–67, and 79–83, 1901; sheet 368, District Mymensingh, Seasons 1854–56, 1901.—Bombay Survey, 1 mile to an inch, sheet 232 (second edition), Districts Poona and Ahmednagar, Seasons 1878–79, 1900.—District Buldána (Hyderabad assigned districts), 8 miles to an inch, 1901. —Central Provinces, index map showing Cadastral Surveys, 1901; index map showing Forest Surveys, 1901. Index to the Standard Sheets of Upper and Lower Burma (new series), 1901. *Presented by H.M. Secretary of State for India, through the India Office.*

AFRICA.

Natal. **Simpson.**

New Military Map of the Colony of Natal. Compiled for Gen. Sir Redvers Buller, V.C., G.C.B., G.O.C., Natal Field Force. Published under the authority of Lieut.-Colonel A. E. Sandbach, R.E., Natal Field Force; Captain H. C. Simpson, N.V.R., F.I.D., Officer-in-charge of Mapping Section F.I.D., Maritzburg. Durban & Pietermaritzburg: P. Davis & Sons; London: E. Stanford; Edinburgh: John Bartholomew & Co. *Price* £2.

In the title this is stated to be a map of Natal, but it also includes considerable portions of the surrounding colonies. It has been specially compiled for military purposes, and, although the style in which it has been produced is decidedly rough, the best available information has evidently been utilized. In addition to the points fixed by triangulation, information has been supplied by local residents, railway survey engineers, and others, while full advantage has been taken of officers' reconnaissances and sketches. Natal is from plans and surveys in the office of the Surveyor-General of the colony, and from information furnished by local surveyors and others, while north of the Tugela Major Grant's map has been made use of. The portion of the Transvaal included is from Captain Simpson's own surveys, and from those obtained from the Surveyor-General's office, Pretoria. This map is doubtless the most complete and up-to-date that has hitherto been published, but it is to be hoped that before long it will be superseded by a regular trigonometrical survey. When complete the map will consist altogether of eight sheets, six of which are already published.

AMERICA.

North America. **Rand, McNally & Co.**

Indexed Pocket Maps of British Columbia, scale 1 : 2,407,680 or 38 stat. miles to an inch; California, scale 1 : 1,964,160 or 31 stat. miles to an inch; and Colorado, scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Rand, McNally & Co. Chicago and New York, 1901. *Price* $0.25 *each. Presented by the Publisher.*

These are new editions. It is to be regretted that they are so roughly executed and indistinct, for they contain much useful information. In the place lists accompanying the maps of California and Colorado, the populations are given according to the census returns of 1900.

GENERAL.

French Colonies. **Pelet.**

Atlas des Colonies Françaises. Dressé par ordre du Ministère des Colonies. Par Paul Pelet. Paris: Armand, Colin & Cie. Livraisons 7. *Price* 3 *francs.*

The seventh part of this atlas, which has just been issued, contains a map of Madagascar in four sheets, on the scale of 1 : 2,000,000, in addition to which there are many insets of neighbouring islands on enlarged scales. Although only recently published, the map is dated January, 1900, and is consequently in some parts already behind the times as regards the geographical information it contains. This is especially noticeable in the south of the island, where the map published this year by the Service Géographique du Corps d'Occupation gives a good deal of information, although the region is left almost a blank on this map.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July and August, 1901. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3191	m = 6·9	England, east coast:—River Thames, Woolwich to Erith. 2*s.* 6*d.*
3158	m = 1·4	Norway, south coast:—Nevlunghavn to Torbiörnskier. 3*s.*
3159	m = 1·4	Norway, south coast:—Torbiörnskier to Jœlöen. 3*s.* 6*d.*
3160	m = 1·4	Norway, south coast:—Torbiörnskier to Rauö. 2*s.* 6*d.*
3203	m = 1·0	Spitsbergen:—Magdalena bay to Red bay. 2*s.* 6*d.*
3194	m = 0·72	Denmark:—Copenhagen road and harbour. 2*s.*
3210	m = 2·9	Plans in the gulf of Genoa:—Rapallo bay. 1*s.* 6*d.*
307	m = 0·2	River St. Lawrence:—West point of Anticosti to Saguenay river. 2*s.* 6*d.*
904	m = 2·9	Cuba:—Guantanamo bay. 2*s.* 6*d.*
1380	m = 3·0	Cuba:—Nipe bay. 2*s.*
443	m = 7·0	Cuba:—Santiago harbour. 2*s.* 6*d.*
1504	m = 5·8	Mosquito coast:—Blewfield lagoon. 2*s.* 6*d.*
3195		Celebes, north coast:—Panang to Pulo Motuo. 2*s.*
3208	m = 0·5	Solomon islands:—New Georgia. 1*s.* 6*d.*
2294	m = 6·0	Sandwich islands:—Pearl river and lochs. 2*s.* 6*d.*
2091		Africa, south-west coast:—Table bay to Donkin bay. Plan added:—Lambert bay.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
300 Plan of Magdalena bay to Foul bay on this sheet. 3020 Plan of anchorage between Vogel Sang and Cloven cliff on this sheet.	New plan. Magdalena bay to Red bay	3203
157 Plan of Portofino on this chart.	New plan. Rapallo bay	3210
307 Magpie bay to point des Monts. 309 Cape Chatte to Bic island.	New chart. West point of Anticosti to Saguenay river	307
98 Plan of port of Guantanamo on this sheet.	New plan. Guantanamo bay	904
423 Plan of port Nipe on this sheet.	New plan. Nipe bay (eastern part)	1380
443 Port of Santiago de Cuba. El Portillo.	New plan. Santiago harbour	443
1504 Blewfield lagoon.	New plan. Blewfield lagoon	1504
1782 Lantau to Lankit islands.		

Charts that have received Important Corrections.

No. 1188, The World:—Coal and telegraph chart. 2007, Scotland, west coast:—River Clyde from Dumbarton to Glasgow. 62A, Channel islands:—Jersey. 2100,

Channel islands:—Plateau des Minquiers. 122, Netherlands:—Mouths of the Maas. 2322, Netherlands:—Scheveningen to Ameland, including the Zuider Zee. 2593, Netherlands:—Ameland to Jade river. 2308, Norway, west coast:—Brand fiord to Leka. 2751, Spitsbergen. 300, Anchorages on the west and north coasts of Spitsbergen. 2669B, Channel islands. 1317, Balearic islands:—Majorca and Minorca. 2157, Sardinia:—Maddalena and adjacent islands. 199, Adriatic:—Brindisi to Ortona. 1483, Adriatic:—Channels to Venice. 2701, Adriatic:—Gulf of Cattaro to Corfu. 271, Newfoundland:—Cape Onion to Hare bay. 1734, Newfoundland:—St. Julien island to Hooping harbour. 280, Newfoundland:—Notre Dame bay. 2775, North America, River St. Lawrence:—Point Pizeau to Frechette island. 98, Places on the south coast of Cuba. 2512, Vancouver island:—Nanaimo harbour and Departure bay. 6B, Gulf of Aden, western portion. 100A, Gulf of Aden:—Ras Galwéni to Ras Hafún. 8E, Red sea, sheet V. 2134, Borneo:—Muara harbour and approaches to Bruni river. 2193, Anchorages between Mindanao and Celebes. 2562, China, south coast:—Canton river. 3026, China, south coast:—Macao to Pedro Blanco. 1180, China, south coast:—Approaches to Hong Kong. 1602, China, north-east coast:—Approaches to the Yangtse Kiang. 1203, Japan:—Uraga harbour. 951, Japan:—Kii channel to Owasi bay. 3155, Australia, east coast:—Flinders group. 983, North Pacific:—Marshall islands.
(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Monthly Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for September and October, 1901. London Meteorological Office. *Price* 6*d*. *Presented by the Meteorological Office.*

U.S. Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September, and of the North Pacific Ocean for September and October, 1901. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

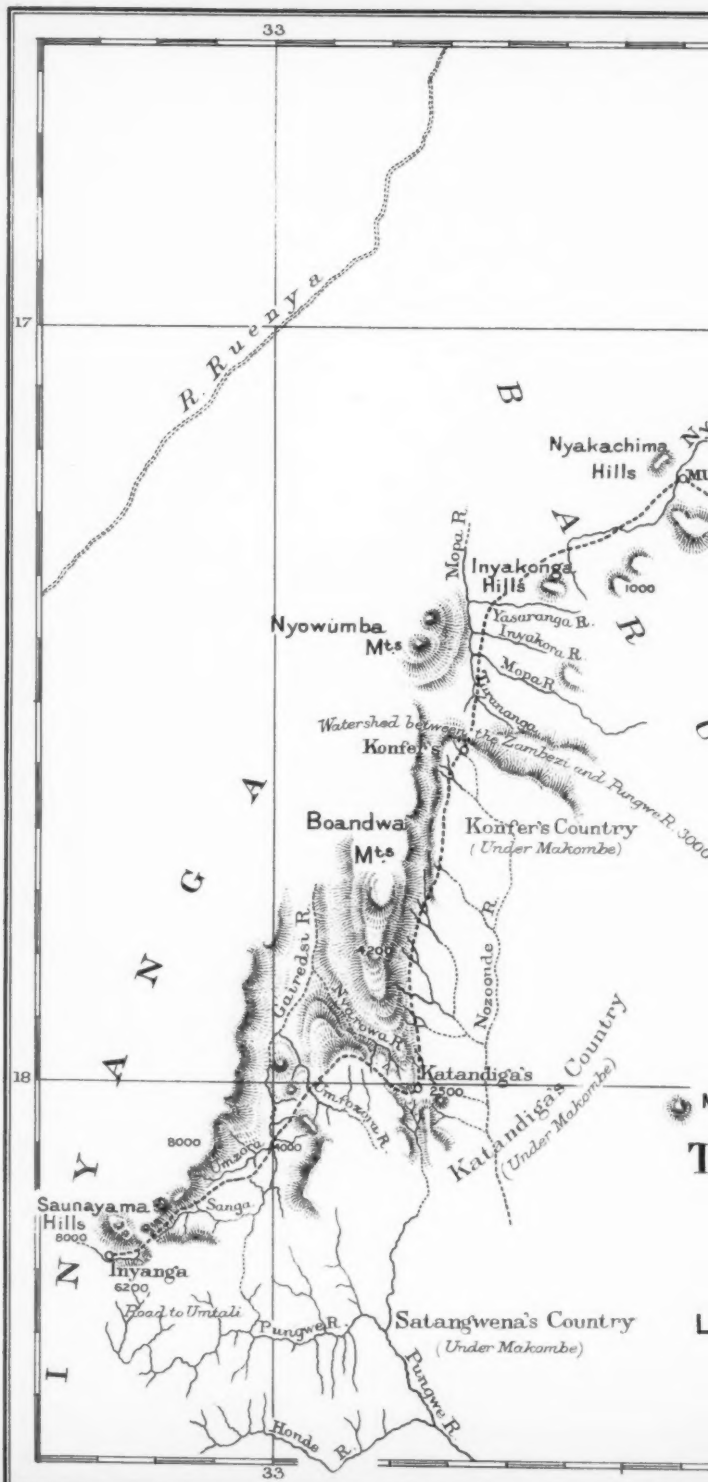
Pacific Islands. **Rooney.**

An Album of fifty-three photographs of people and scenery of New Britain and New Ireland, etc., by the Rev. Isaac Rooney. *Presented by the Rev. Isaac Rooney.*

An interesting series of photographs measuring about 7 × 5 inches. They are well taken, and, as will be seen by the titles, thirty-three represent types of natives, whilst the remainder principally illustrate characteristic scenery and mission stations.

(1) Port Hunter, Duke of York island; (2) New Ireland scenery; (3) Port Hunter, looking north; (4) Remains of French settlement, New Ireland; (5) Wesleyan mission house, Kabagada, New Britain; (6) French settlement, New Ireland; (7) Teacher's house, Port Hunter; (8) Native feast, Duke of York island; (9) Marquis de Rey's settlement, New Ireland; (10) Sacred canoe, Port Hunter; (11) Teacher's house, Duke of York island; (12) Small native church, Duke of York Island; (13) Native chief and sacred canoe; (14) Native houses, New Britain; (15) Mouth of river, New Ireland; (16) Dukduk (a sacred society); (17) New Ireland river; (18) Native dance, New Britain, 1879; (19) Natives of Port Hunter, 1879; (20) Survivors of Marquis de Rey's expedition rescued and brought to Port Hunter by the mission, 1879; (21) Aminio Bale and wife (Fijian teachers); (22) Samoan teacher and wife; (23) Samoan teacher and wife, Duke of York island; (24) Wesleyan mission house, Port Hunter; (25) Port Hunter; (26, 27) New Britain chiefs; (28, 29) Samoan women; (30, 31) Chief and family, Port Hunter; (32) King Dick and his two wives; (33) Tongan teacher and New Britain natives; (34-39) Duke of York natives; (40) Son of chief (Warrawarrum); (41-53) No titles.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


33
17
18
R. Ruenya
Nyakachima Hills
Inyakonga Hills
1000
Mopa R.
Yasaranga R.
Inyakoru R.
Mopa R.
Nyowumba Mts
Watershed between the Zambezi and Pungwe R.
Konfer's
Konfer's Country
(Under Makombe)
Boandwa Mts
4200
Nozoonde R.
Gairedsi R.
Katandiga's
2500
Katandiga's Country
(Under Makombe)
8000
Umzoru
Saunayama Hills
8000
Sanga
Inyanga
6200
Road to Umtali
Pungwe R.
Satangwena's Country
(Under Makombe)
Honde R.
INYANGA
BARUE

THE BARUE COUNTRY

FROM INYANCA TO THE ZAMBEZI RIVER

from a survey by

LT COLONEL A. J. ARNOLD. D.S.O.

October - November 1900.

Scale of Miles

0 10 20 30

Nat. scale 1:1,000,000 or 15·78 miles = 1 inch.

Heights in feet